PUBLISHERS OF LAW BOOKS
PRINTERS AND BOOKBINDERS
The Carswell Company
LIMITED
145-149 ADELAIDE STREET WEST
TORONTO CANADA

Southam



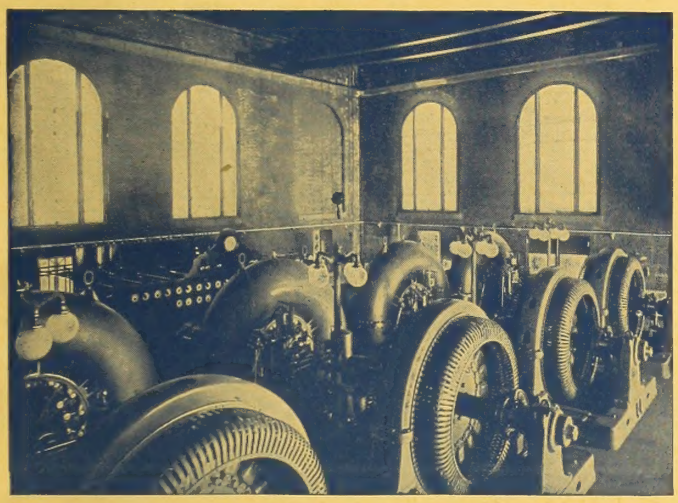
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Vol. XXII—No. 13 Toronto, July 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



"Smith" Francis Turbines

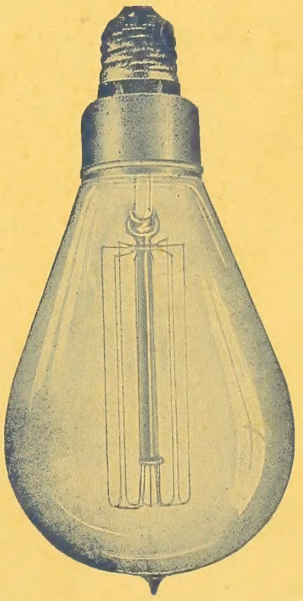
Power house of the Metropolitan Water and Sewerage Board, Clinton, Mass. (now owned by State of Massachusetts), where we have four hydraulic turbine units, each of 1600 Horse Power, under 100 ft. head, in constant operation. Turbines designed for heads from 5 feet to 600 feet.

SEND FOR BULLETIN N

S. Morgan Smith Co., York, Pa.

Branch Offices: 176 Federal St., BOSTON, MASS.
644 American Trust Bldg., CHICAGO

Use 3 lights at the old cost of One



For the same money that you now pay for current for the old-style carbon lamp, you can have your choice of

3 times as much light in each room—or
3 times as many rooms lighted—or
3 times as many hours of light

if, instead of the carbon lamp, you use

C. G. E. MAZDA LAMPS

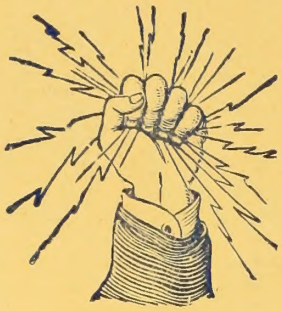
Canadian General Electric Co., Limited

HEAD OFFICE - TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Winnipeg Regina Saskatoon
Calgary Edmonton Vancouver Victoria Nelson Prince Rupert Fort William

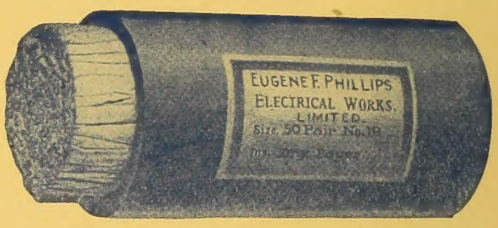
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Bare and Insulated Copper

WIRES AND CABLES



For Telephone, Telegraph, Lighting, Power and Street Railway Equipment

Bare and Insulated Electric Wire and Cables for Aerial and Underground use

Railway, Feeder and Trolley Wire



Weatherproof Magnet and Rubber Covered Wires and Cables

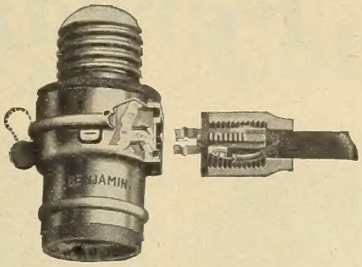


Incandescent and Flexible Cords

Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

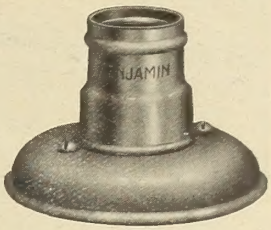
Branches: Halifax, Toronto, Winnipeg, Vancouver



Cat. No. 96



Cat. No. 4200

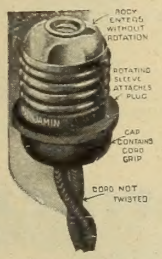


Cat. No. 60020

Benjamin Electrical Specialties

SAVE YOU

INCONVENIENCE
TROUBLE
MONEY
TIME

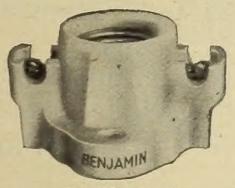


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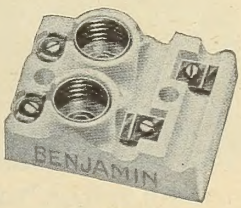
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Look through Catalog C-21

"BUY BENJAMIN"
Made in Canada
FROM YOUR JOBBER

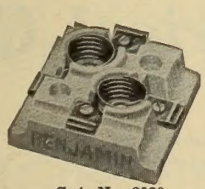


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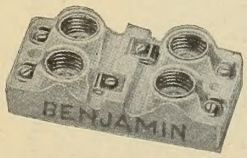
Benjamin Electric Mfg. Co.

of Canada, Limited

11-17 Charlotte St., Toronto



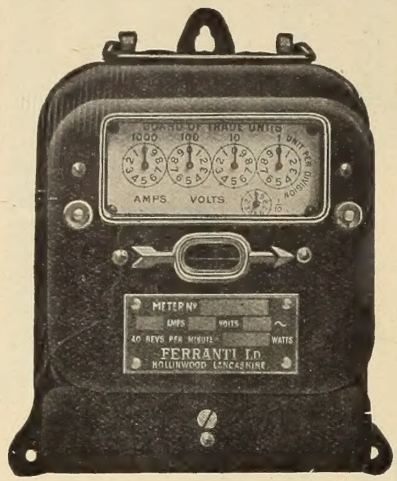
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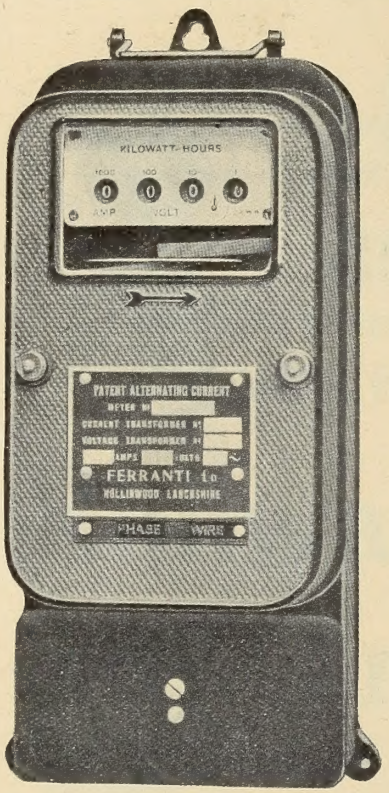
Cat. No. 62587



Cat. No. 62965



SINGLE PHASE METER



POLYPHASE METER

Ferranti

Single and Polyphase

Type "C" Meters

represent a higher grade of mechanical construction.

Ferranti Meters embody that simplicity of construction which assures perfect accuracy and permanent reliability. Their efficiency under light or heavy loads of short or long duration has been proven to the satisfaction of hundreds of constant users.

Cyclometer or clock dials; top or bottom connections.

Every meter carefully inspected and tested before leaving our factory.

Prompt shipments made from our large stocks at Toronto and Winnipeg.

Ferranti Transformers

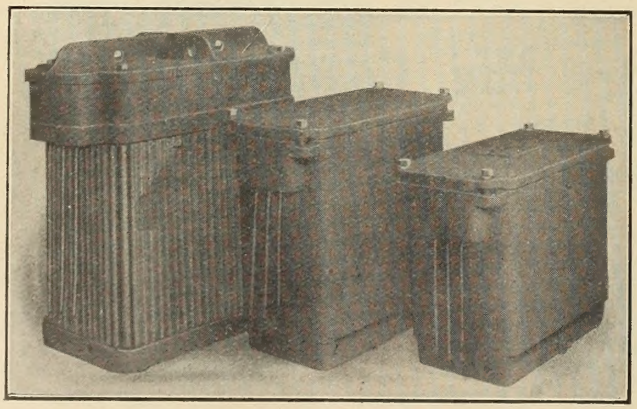
highly efficient at all times.

Of all transformers the three phase type is the most economical to operate and most saving in construction costs.

The efficiency of Ferranti Three Phase Transformers is apparent because of the great reduction in energy-loss. The transmission line thus equipped is invariably a profitable one.

All coils are wound by the latest approved methods, thereby reducing losses to a minimum.

We also supply Switch Boards, Motor Panels and Instruments.



Three Phase Pole or Station Transformers

Write for Further Particulars and let us make an estimate for you.

The Ferranti Electrical Co.

of Canada, Limited

90 Sherbourne St.
TORONTO
and
56 Albert St.
WINNIPEG

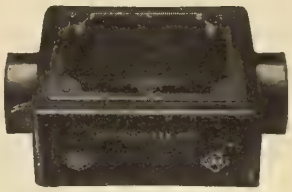
Railway Condulets



Type BLMC—For Bracket Lamp Outlets. Takes Round Base Fittings.



Type CLOC—For use with Centre Ceiling Fittings.



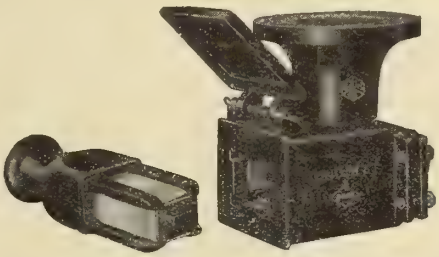
Type JRR—For use back of Mouldings with Rectangular Base Fittings.



Type DSOC—For Deck Sill Outlets. Takes Round Base Fittings.



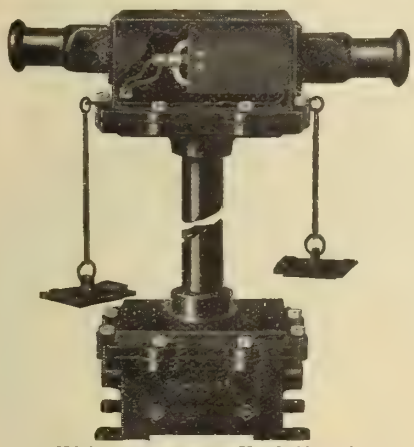
Type MD—Receptacle and Plug for Dynamo-Regular Connection.



Type BRHS—With 100 Ampere Receptacle and Plug. Battery Charging Equipment for car.



Type PJCA—Medium Size Weather-proof Junction Box.

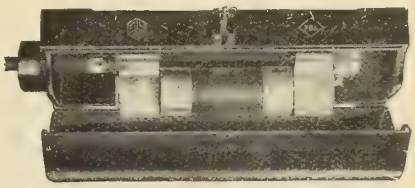


Type UGC—Arranged as Yard Charging Equipment for Underground Conduit System.

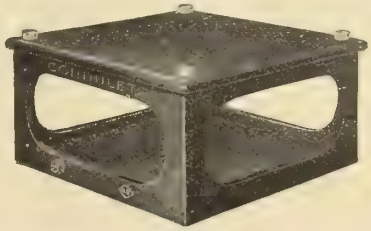


Two-Hub Side Plate for Type RS Condulet.

The Condulets shown here are only a few of the many types designed to simplify and improve conduit installations in railway cars, buildings and yards. Whatever the requirement, we have a Condulet to meet it.



Type FBL—Weather-proof Housing for 100 to 200 Ampere Battery Fuse.



Type RS—Detachable Sides, Weather-proof Junction Box.

You can secure detailed illustrations, descriptions and listings of all Railway Condulets by signing the attached coupon and mailing it to us.

Order Condulets from your dealer. If he does not stock them, write us.

Crouse-Hinds Company of Canada, Ltd.

Main Office and Works:

Toronto, Ontario, Canada

Kindly send me free copy of Condulet Bulletin No. 101.

Name.....

City.....

Prov.....

2713



Architects	Warren & Wetmore	New York
Engineers	Mailloux & Knox	New York
Electrical Contractors	J. Livingston & Co.	New York

Across Canada

with the

Imperial Wire & Cable Company, Limited

Toronto Montreal Winnipeg

First of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows

The Ritz-Carlton Hotel
Montreal

This hotel was wired with **"Imperial Higrade"** Rubber Insulated Wire.

This is the Trade Mark to look for ☛

Address Inquiries to Nearest Office

Montreal Toronto Winnipeg

Alberta and British Columbia Inquiries to

Northern Electric & Manufacturing Co., Limited
Calgary and Vancouver

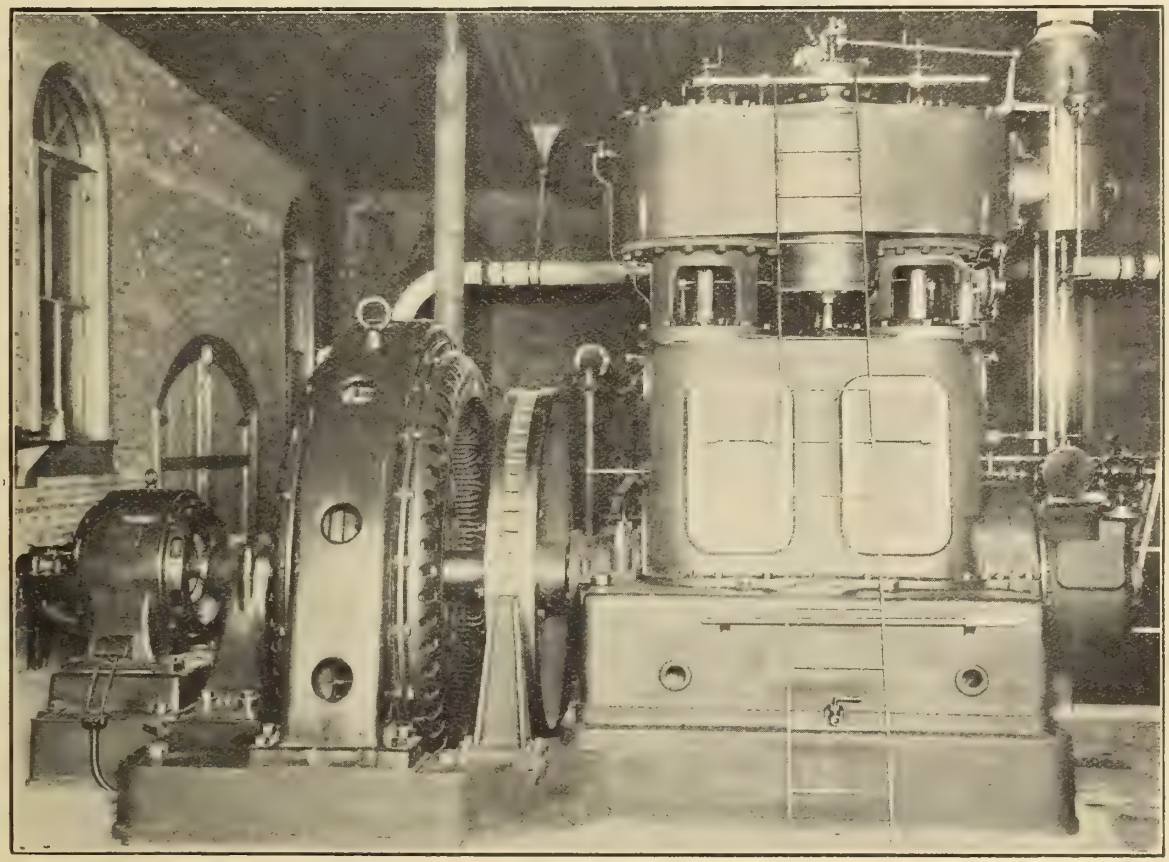


"Adanac" "Imperial Higrade" and "30% Para"

Imperial Wire & Cable Company, Limited

Toronto Montreal Winnipeg

High Grade Electrical Apparatus



375 K.V.A. 2300 volt 2 phase 60 cycle 360 R.P.M. A.C. generator direct connected to a Belliss & Morcom high speed engine supplied to the corporation of Wetaskiwin, Alta.

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR

The General Electric Co., of Sweden

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers

Galvaduct
Loricated



Anderson Apartments, Calgary

Galvaduct
Loricated

A Galvaduct Building

"Galvaduct"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated

"Loricated"

A high class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you — write

Galvaduct
Loricated

Conduits Company Limited

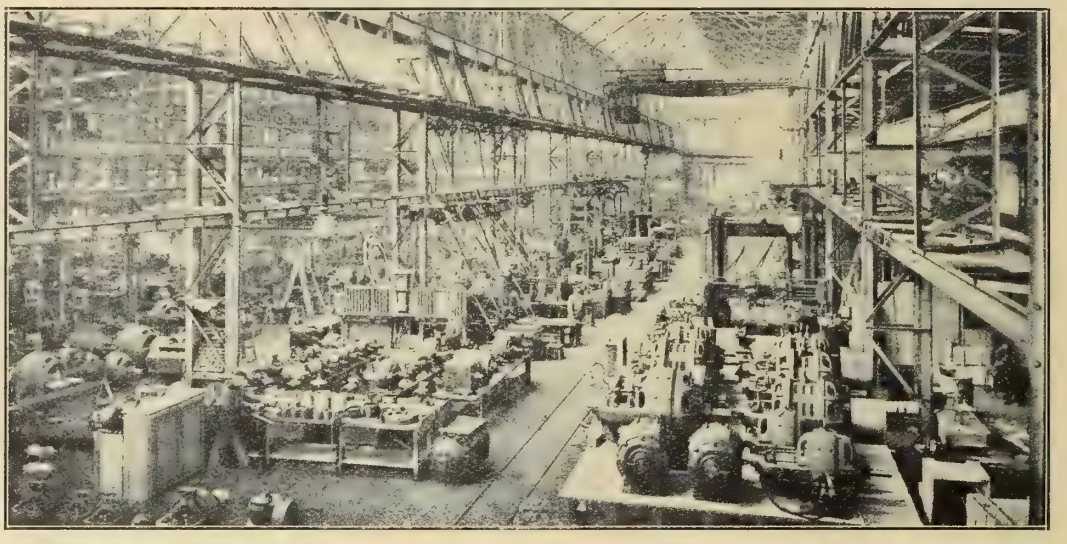
Toronto - Montreal

Galvaduct
Loricated

THE CANADIAN UNION ELECTRIC CO., LTD.

Manufacturers of

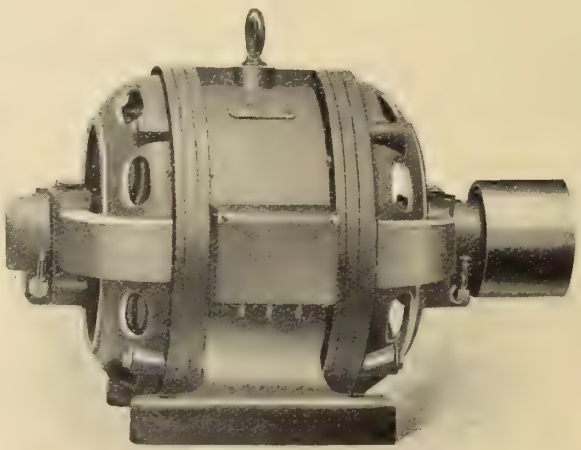
Dynamos Motors Alternators Long-Burning Flame Arc Lamps, 120 hours Etc.



A photographic view of one bay in the Factory, showing Union Dynamos and Motors in process of manufacture

Stock carried at MONTREAL, TORONTO, WINNIPEG and VANCOUVER

High Efficiency
Great Overload Capacity
Ample Ventilation



Sound Mechanical Construction and Smooth Running

Pattern H.D. Squirrel Cage Motor

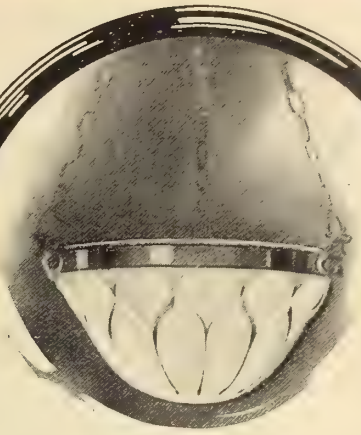
CANADIAN UNION ELECTRIC CO., LTD.

122 Wellington St., West
TORONTO, ONT.

9 St. Nicholas Street
MONTREAL, P.Q.

THE MAINER ELECTRIC CO., LTD., 61-3 Albert Street, WINNIPEG, MAN.

You, too, should feature *Delica White Lighting Glassware*





IT'S profit to you — that's the only basis upon which we urge you to handle Delica White.

¶ There is only one basis upon which we urge you to handle Delica White, and that is—***it's profit to you.***

¶ Its remarkable popularity is the result—not of chance, by any means—but of ***sterling quality,*** plus the knowledge gained by a ***carefully systematized study of the public taste and need.*** In other words,

It is a perfect glassware—made the way the people want it!

¶ In diffusing powers it is unrivalled. No matter how intense the light, Delica White completely breaks all glare. Its color is an indescribable variety of white without speck or spot, very decorative and agreeable to the eye. It is made for both direct and semi-indirect installation—simple or elaborate.

¶ *The price is reasonable.* There is absolutely no reason why you should handle inferior ware when you can sell Delica White at the same price, make the same profit on each sale, *and make twice as many sales.*

¶ We want you to try it. Give it a chance to prove its salability. You will find it the strongest member of your lighting glassware family. Write for our new catalogue.

The Pittsburgh Lamp, Brass & Glass Co.
of Canada, Limited

119 Wortley Road, London, Ont.

PILABRASCO

R. E. Davis, Representative

CLOTHES DON'T MAKE THE MAN

but good clothes certainly add to appearances

TUNGSTOLIERS DON'T MAKE THE HOME or STORE

but good neat fixtures certainly add to same

—YOU—

SURELY AGREE WITH THE ABOVE STATEMENTS

then—why not sell perfectly made fixtures

YOUR BUSINESS WILL GROW IF YOU DO

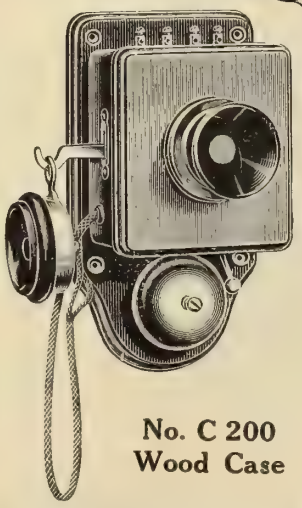
if you want the best trade—get it—sell tungstoliers

The Tungstolier Company of Canada Limited

Manufacturers of Perfectly Made Lighting Fixtures

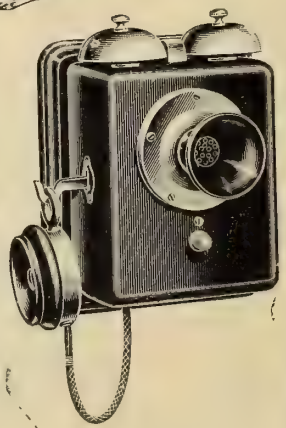
Head Office—212 King St. West Toronto, Ont.

BRITISH MADE
STERLING
TELEPHONES



No. C 200
Wood Case

Cheap Phones with Induction Coils (Battery Ringing)

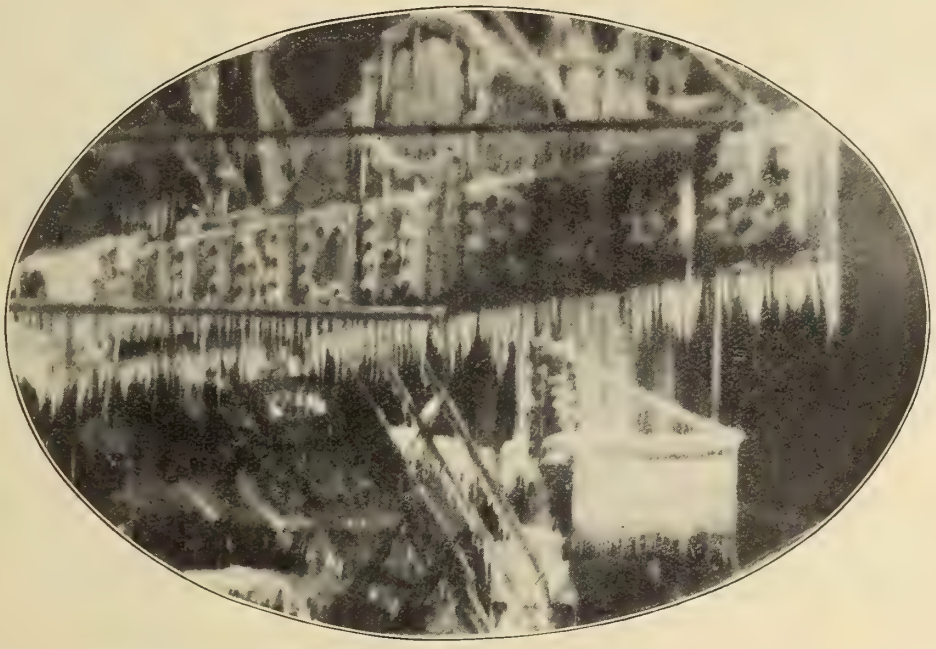


No. C 206
Steel Case

Agents for Sterling British Made Phones:—

MANITOBA.—The Can.-Brit. Engineering Co., Ltd., 324 Smith Street, Winnipeg.
ONTARIO.—Chapman & Walker, Ltd., 116-118 Richmond St. W., Toronto.
SASKATCHEWAN.—The Northwestern Electric Ltd., Scarth Street, Regina.
BRITISH COLUMBIA.—Cope & Son, Ltd., Water Street, Vancouver.
ALBERTA. — General Supplies, Ltd., 122 Eleventh Ave. W., Calgary.
QUEBEC.—Stocks kept by: Dawson & Co., Ltd., Montreal. Mechanics Supply Co., St. Paul, Que.
NOVA SCOTIA.—Stocks kept by: John Starr, Son & Co., Limited, Halifax.
NEW BRUNSWICK.—Stocks kept by: St. John Railway Dock St.

Fire And Water Can't Harm The Federal



An actual photograph of a Federal Electric Sign, taken after a fire on Wabash Ave., Chicago. The building was gutted but the sign was still burning when the photograph was taken. It was surrounded by flames and encrusted with ice and not only was uninjured but sustained the weight of the fire escape which fell from above.

The Federal Porcelain Enamelled Steel Sectional Sign is fire, rust and water proof and is almost indestructible. The frame is made of heavy galvanized channel iron and the letters of embossed steel plates, porcelain enamelled inside and out. Our patented clamp socket is used, clamped directly to the steel plate. The shell is pure copper and the porcelain is designed to prevent the entrance of moisture.

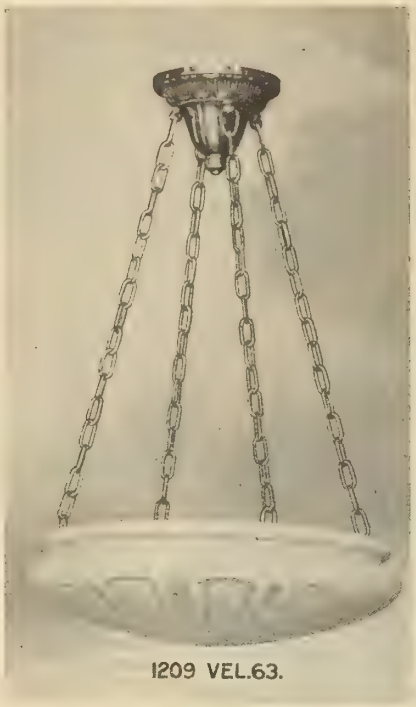
The Federal Electric Sign is made in any style or size. They can be secured with letters on both sides, or set flat against a building, with letters on one side only. Vertical signs are supplied where city regulations or conditions prevent the use of horizontal projecting signs. They meet all the requirements of the Underwriters' rules.

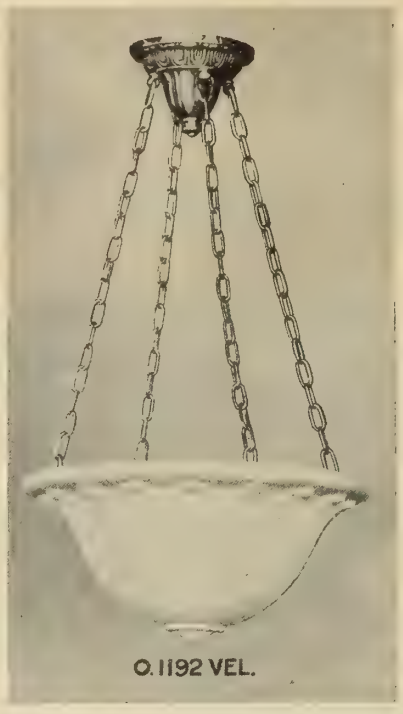
Central Stations—Write for Bulletin 27111 today.

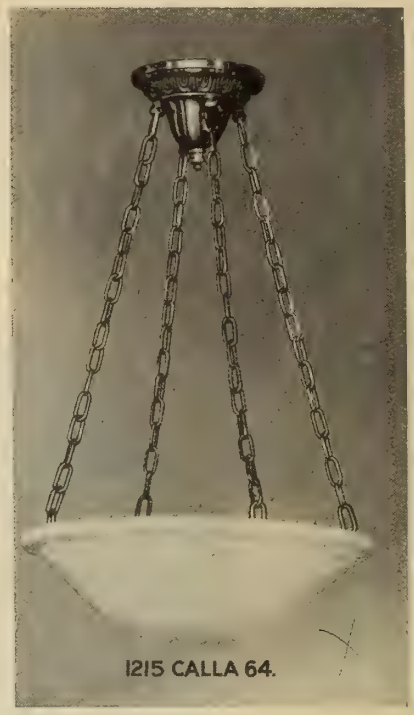
Federal Signs are sold F. O. B., Factory, Hamilton, Ont.

Federal Sign System (Electric)

Lake and Desplaines Street, Chicago







Fixtures a suggestion only, we furnish glass and bands.

Three of our numerous new semi-indirect units, made in several sizes and in Veluria, Calla or Pyra glass; write for details.

The Holophane Co., Limited, Toronto, Can.

The design of Crocker-Wheeler Induction Motors

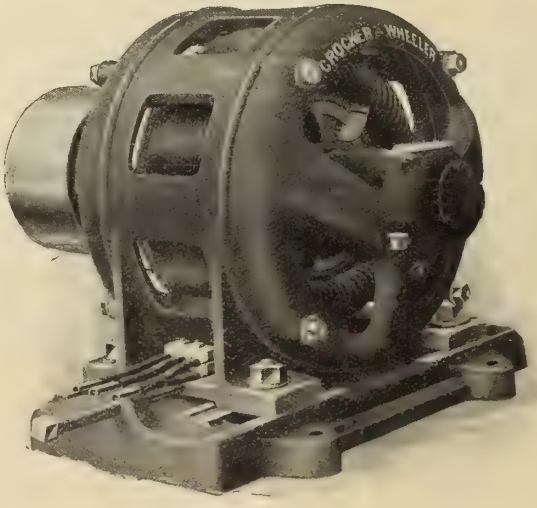
includes

Large Shafts

Ideal End Ring Construction

High Power Factor

Large Journals



Lumen Bearings

Strong Stator Frame

Heavy Insulation

Best Efficiency

They have many other desirable features

Bulletin 155 describes them

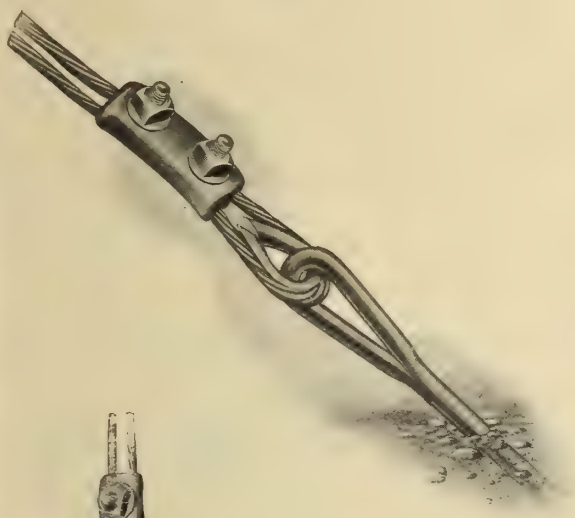
THE CANADIAN CROCKER-WHEELER CO., LIMITED

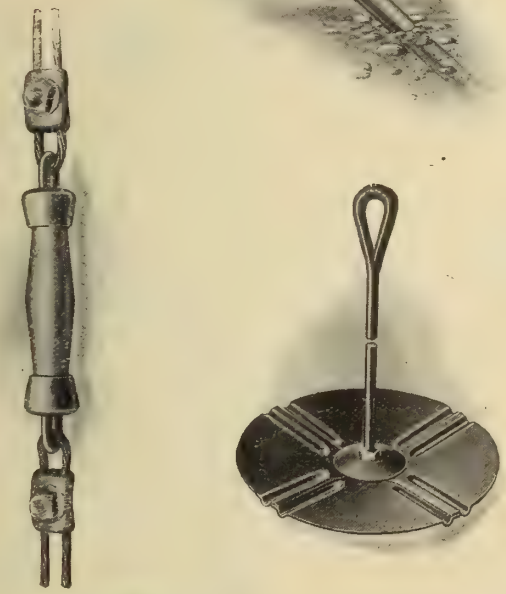
MANUFACTURERS AND ELECTRICAL ENGINEERS

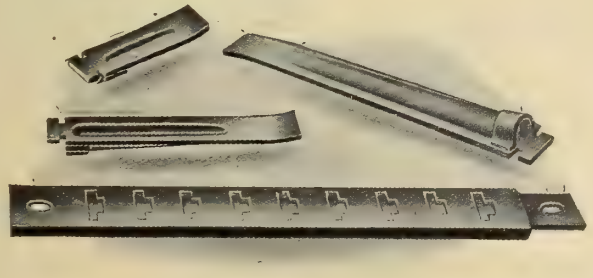
HEAD OFFICE AND WORKS:
ST. CATHARINES, ONT.

DISTRICT OFFICES:
MONTREAL, QUE. TORONTO, ONT. VANCOUVER, B. C.









B. & K. Pressed Steel Line Specialities

B. & K. products effect a great saving in construction cost, cut the freight cost, and save labor.

All B. & K. specialities are made of pressed steel.

The B. & K. Bracket is strongly constructed of pressed steel with electrically welded heels and will sustain 200 lbs. on extreme end of the 10 inch heel.

The Guy Clamp is a simple yet powerful device. The One Bolt Clamp is simple and especially serviceable for trolley spans.

The B. & K. Mushroom Guy Anchor is built in sections and has many advantages.

1. Being scientifically proportioned pressed steel every fraction of weight is doing something.

2. The 10-inch Hook will sustain the weight of a 200-lb. man when using the hooks as a means of emerging from a man-hole.

3. The electrically welded heel makes it a one-piece hook.

4. No disturbing of cable in setting up as a vertical movement of only 5/16 of an inch is required to insert the bracket.

5. Due to the generous bearing surface, the tendency of the lead sheathing to cold flow is eliminated.

6. Having slots pierced in racks 1 1/2 in. to centers gives a great range of positions.

7. Having offset in lower end of rack allows for extending the rack without using additional bolts, making thereby one continuous rack.

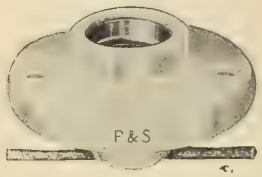
8. The entire process of manufacture is one of dies, producing a system of interchangeability that creates uniformity on the job.

9. Due to the enormous production per day of pressed steel articles, we can produce this bracket lower in cost than any other on the market.

Write for the B. & K. Catalogue.

BARNES & KOBERT
Manufacturing Co.
New Haven, - Connecticut





Ask your jobber to show you samples of P & S weatherproof conduit box receptacles.

The illustrations show two styles for 3 and 3¼ inch boxes.

Each receptacle is supplied, packed in a handy paper box, **Complete with Machine Screws** with which to fasten the receptacle to the box.

Ask your jobber to-day.

Pass & Seymour, Inc.

Main Office and Works:
Solvay, New York, U. S. A.
San Francisco, Rialto Building

Sold By All Jobbers

Carried in Stock by:

John Starr, Son & Co., Ltd. Halifax
St. John Railway Company St. John, N. B.
Mechanics Supply Co., Ltd. Quebec
Dawson & Company, Limited Montreal
Central Electric and School Supply Company, Toronto
Mainer Electric Company Winnipeg
Dawson & Co., Winnipeg
General Supplies Limited Calgary, Alta.
Cope & Son, Vancouver



BANNER
TRADE MARK.

Artistic and Attractive Designs in

Lighting Fixtures

"Banner" Electric Fixtures embody all the popular and most up-to-date designs together with many of our exclusive creations.

Write us for an estimate on your next job.

We specialize on making fixtures from original drawings on short notice.

"Banner" Fixtures

MADE BY



Ontario Lantern & Lamp Co., Limited,
HAMILTON, CANADA.

That Cable and Those Circuits

will have to be tested out this month

Send your order now for a



PEERLESS TESTING SET

Bridge Arms to 1/20 of 1%. Rheostat to 1/10 of 1%. Guaranteed accuracy.

The price is as low as is consistent with the excellence of the materials used.

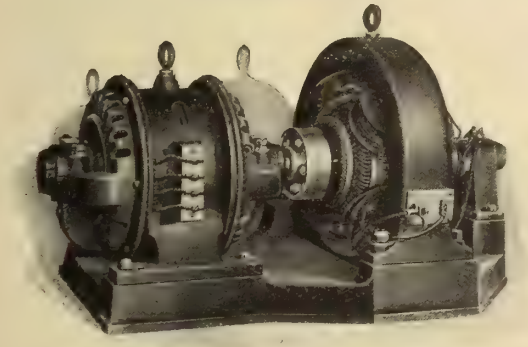
Adopted as standard by the largest and most critical buyers in the United States whose purchase is your guarantee of the quality.

Thompson-Levering Company

323 Arch St., Philadelphia, Pa.

Toronto & Hamilton Electric Company

HAMILTON

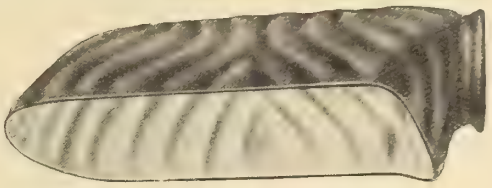


Make

MOTORS FOR ALL CIRCUITS
DYNAMOS FOR POWER AND LIGHT
AND ELECTROPLATING

Repairs Executed Neatly and Promptly
Write us

An X-Ray Reflector Worth Knowing



"MIDGET"

(No. 510)

A small reflector, 6½ ins. long and 1¾ ins. high, for use in lighting show cases, wall cases, pictures, small show windows and any interiors illuminated from cornices. It uses the new 25 watt tubular tungsten lamp.

X-Ray Reflectors are the only reflectors made exclusively for lighting different size store windows. They are the most powerful reflectors made; use the least current and cost the least to maintain. They are designed to illuminate the merchandise in a way to make it stand out like the stage display in a theatre. Their brilliancy is everlasting.

New Window Lighting Book

Describes the Full Line

In short, X-RAY reflectors have every point of superiority that 14 years study and experience in store window lighting have shown us must be present. That explains why we sell tens of thousands every year through the electrical trade. Are you getting any of these profits?

NATIONAL X-RAY REFLECTOR CO.

General Offices
Chicago
225 W. Jackson Blvd.

New York Office
The Eye Comfort Lighting Shop
14 W. 33rd St.

Packard

SUPERIOR QUALITY

Packard

Whenever you see this trademark

THINK OF

LAMPS, METERS and TRANSFORMERS

It stands for the highest attainment both in design and mechanical construction. It is an absolute guarantee of quality. It is a positive insurance against breakdown and failures.

Large stock, from which we make prompt shipments, carried at St. Catharines and Winnipeg; St. John Railway Co., St. John, N.B; General Supplies, Limited, Calgary, Alta.

The Packard Electric Company, Limited

Factory: ST. CATHARINES

General Sales Office;
901-902 Traders Bank Building,
TORONTO

N. W. Office and Warehouse
WINNIPEG

Packard

HIGH-GRADE WORKMANSHIP

Packard

G. M. Gest

Conduit
Engineer & Contractor

503 Power Building, Montreal, Can.



NEWTYPE
BERGMANN
LAMPS

(*Tungsten Filament*)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO., LIMITED

329 CRAIG STREET WEST
MONTREAL, P.Q.

LIVE AGENTS WANTED ALL OVER CANADA



WIRES
and
CABLES



Bare and Insulated in Copper and Aluminum

Railway Feeder Cables
in Copper and Aluminum

Copper Trolley Wire

Copper Clad Wire
(Duplex Metals)

Galvanized Steel Strand
Guy Wire



Canada Wire & Cable Co.
Limited

1170 Dundas Street, TORONTO

Stocks of Wire and Cable carried in Toronto, Montreal, and Winnipeg.

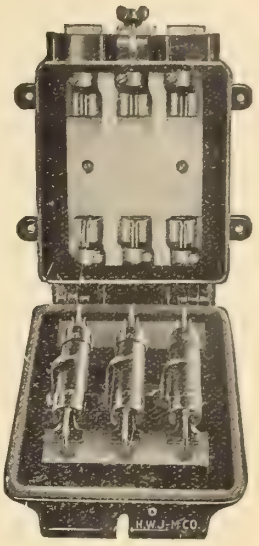
SALES AGENTS:

Roper, Clarke & Co. Limited, MONTREAL
A. E. Esling, Scott Block, WINNIPEG
Macdonald, Marpole Co. Limited, VANCOUVER
Messrs. Gorman, Clancey & Grindley, Ltd. CALGARY and EDMONTON



Dependable Protection is Good Economy

"Noark" Service Boxes can be depended on to protect your electrical apparatus and power lines against overloads or short circuits.



"Noark" Service Boxes

have the following advantages:

(1)—Save repair and maintenance expense.
(2)—Combine a cut-out and switch in one "Approved" Device.
(3)—Are water, weather and gas-tight.
(4)—Have interchangeable conduit fittings.
(5)—Take Standard "N.E.C.S." Fuses.
(6)—Can be opened without disturbing the Fuses or Circuit. (See illustration.)
(7)—Are furnished in a complete line of 2 or 3 pole from 1 to 600 amperes, 250 volts; 1 to 600 amperes, 2 pole; or 61-600 amperes, 3 pole, 600 volts.

Write our nearest Branch for full information and a copy of "NOARK" Catalog No. 406.

The Canadian H. W. Johns-Manville Co., Ltd.

Manufacturers of Asbestos and Magnesia Products — ASBESTOS — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

(1485)

Sundh Sump and Tank Switches
are the Simplest and Strongest

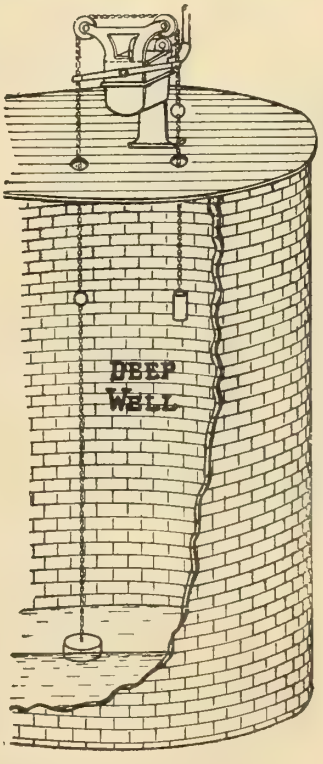
Unequalled for controlling water levels in tanks, wells or sumps.

Absolutely weather proof and will perform their duty with reliability.

Furnished, single, double, three or four pole. Always give a quick, sharp make and break.

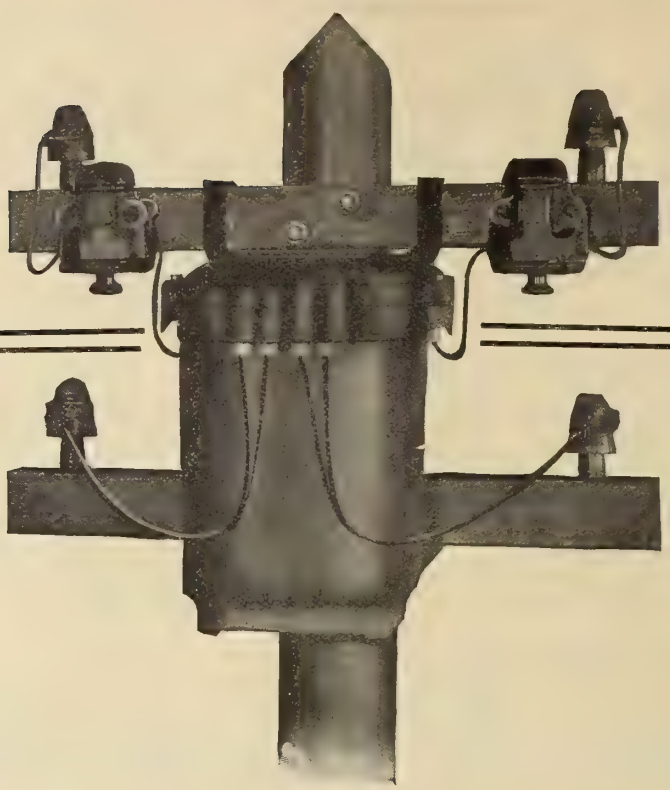
"Sundh" Switches, Panels and complete line of Controlling Devices described in our catalogue.

Send for one to-day



Sundh Electric Co., New York, U.S.A.

Represented by the C. H. L. Keeler Co., Ltd., Toronto, Can.



Moloney
On the Line



FOR sixteen years we have manufactured high efficiency transformers—we make nothing else. Moloney transformers whether on the line or in the station will transform current with the lowest possible core loss because they are designed and built by experienced electrical engineers.

A Moloney will give high commercial efficiency every day and all day long.

Buy or specify Moloney—it is best.

Our catalogue should be in your office.

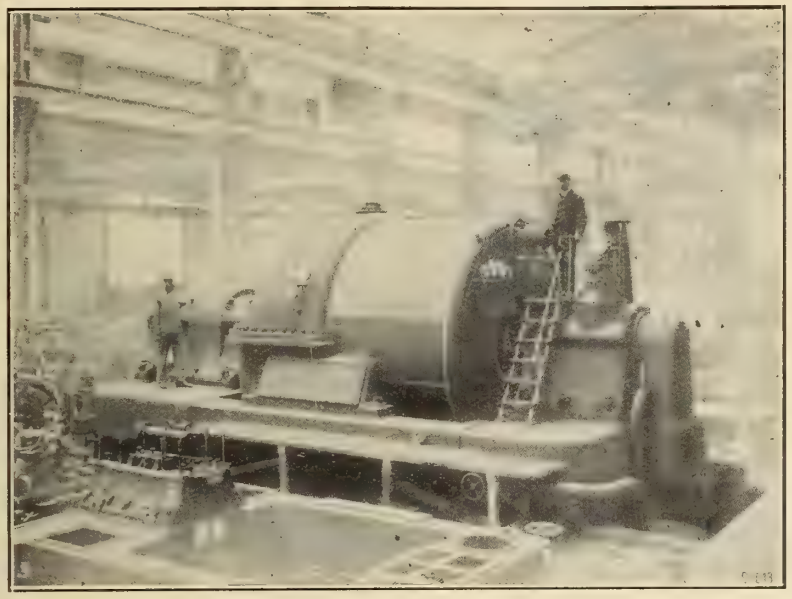


Canadian Moloney Electric Co., Limited

WINDSOR, ONT.

Complete stocks at Windsor, Winnipeg, Vancouver

ESCHER WYSS



28,000 H. P. Zoelly Steam Turbine

Zoelly Steam Turbines

up to

15,000 K. W.

Water Turbines

Impulse Wheels

Turbo-Pumps

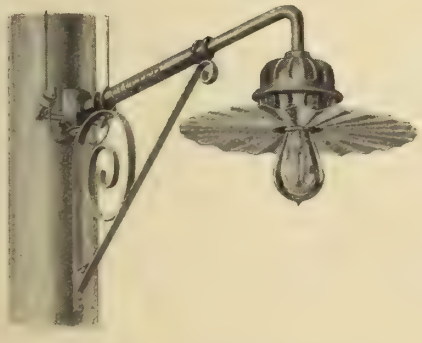
Refrigerating Plants

Escher Wyss & Co., 626 Coristine Bldg., Montreal

Make Yours "THE CITY BEAUTIFUL"

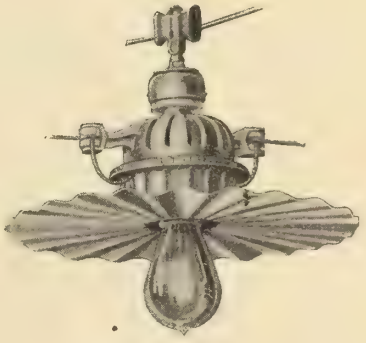
- - Install - -

CUTTER STREETHOODS



Cutter Boulevard Telescope Bracket with One-Piece Fluted Streethood.

Substantial Construction
High Insulation
Easy to Install
Artistic Appearance



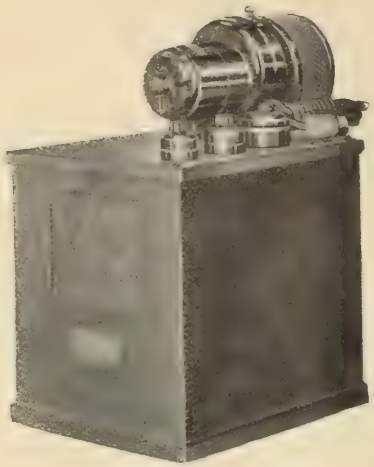
Style G—High Voltage Cable Grip Suspension Streethood.

The body of our new type streethood is a reinforced porcelain insulator designed to receive series or multiple sockets. The fluted steel reflector is fire enameled—blue on top and white on the reflecting surface.

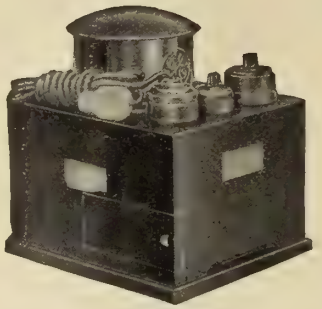
Write for Catalog No. 12

GEORGE CUTTER COMPANY, South Bend, Indiana, U.S.A.

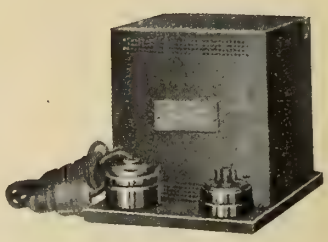
423 Notre Dame Street



Universal Ozonator



Household Ozonator



Utility Ozonator

Inexpensive Ozone Now Available

Until recently the extensive use of ozone has been limited by the lack of any economical and practical method for producing ozone for everday use.

This point was carefully considered in designing C. G. E. Ozonators, with the result that ozone can now be produced in any desired quantity, and at a very low cost, by using the proper size of C.G.E. Ozonator.

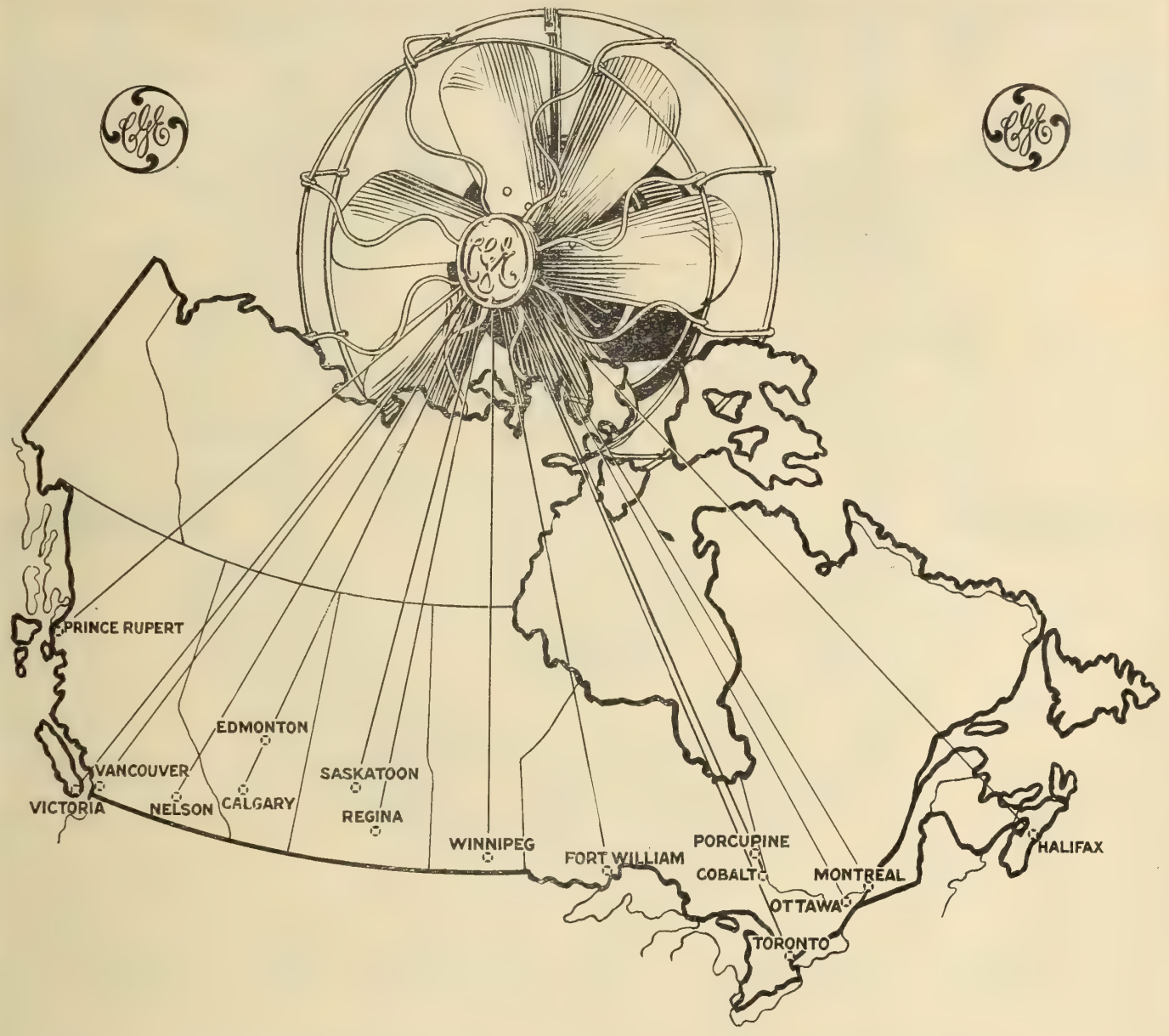
C.G.E. Ozonators are now widely used for improving ventilation and for destroying objectionable odors in factories, hospitals, public buildings, theatres, restaurants and stores. Their use in the home is also increasing.

Be prepared to meet the growing demand for these devices, by keeping in your stock at least one sample of each of the standard sizes.

Canadian General Electric Co., Limited

Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
Cobalt Regina Edmonton Porcupine Saskatoon Nelson Prince Rupert



Prompt Shipments From Stock

Customers are insured against all unavoidable delays in the delivery of C. G. E. Fans. Stocks are now in our warehouses in different parts of the country ready for your call by wire, phone, or mail order.

Anticipate the hot weather demand by placing an assortment of C. G. E. Fans in your stock.

Our nearest District Office will be pleased to give you new descriptive matter and latest prices.

Canadian General Electric Co., Limited

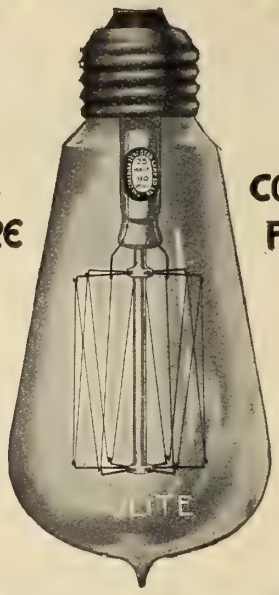
Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
Cobalt Regina Edmonton Porcupine Saskatoon Nelson Prince Rupert

"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE



CONTINUOUS FILAMENT

"The Lamp With a Record"

Quality first, last and always

Dealers Supplied with their own Advertising literature.
Now is the time to advertise for your fall lamp trade.

Get our resultful selling literature

Place your fall orders now

"NULITE"

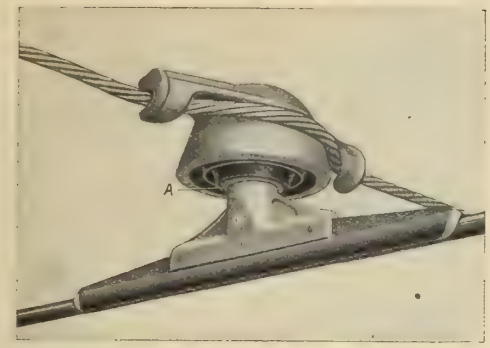
A Canadian Product Manufactured by

THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.

AGENCIES: T. McAvity & Son, St. John, N. B.; Farquhar Bros. Ltd., Halifax, N. S.;
Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto Ont.



No Chattering Threads with O-B Lock Hangers

There is always a tight joint between hanger and boss of ear at "A" when ear is aligned with trolley wire.

Details on pages 97-98 of Catalogue No. 12

THE OHIO BRASS COMPANY, Mansfield, Ohio, U.S.A.

Profit Makers For The Summer Months

Fansteel Irons
Fansteel Disc Heaters
Hughes Ranges
Universal Toasters
Universal Irons
Universal Coffee Percolators
Radiant Toasters

We carry a full line of specialties

Mainer Electric Co., Limited

Winnipeg, Man. **Edmonton, Alta.**

The largest Electrical Supply House in the West

The Lachute Shuttle Co., Limited

Lachute Mills—P.Q.

Manufacturers of

Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.

Moonstone Glass



Grecian Lantern



Canteloupe Ball

¶ Those interested in Illuminating Glassware will be glad to know that our latest design of Lantern and Ball Globe is completed The Grecian Lanterns and Canteloupe Ball Globes are decorative and efficient Being made of Moonstone Glass the absorption of light is less than from any other semi-translucent glass on the market

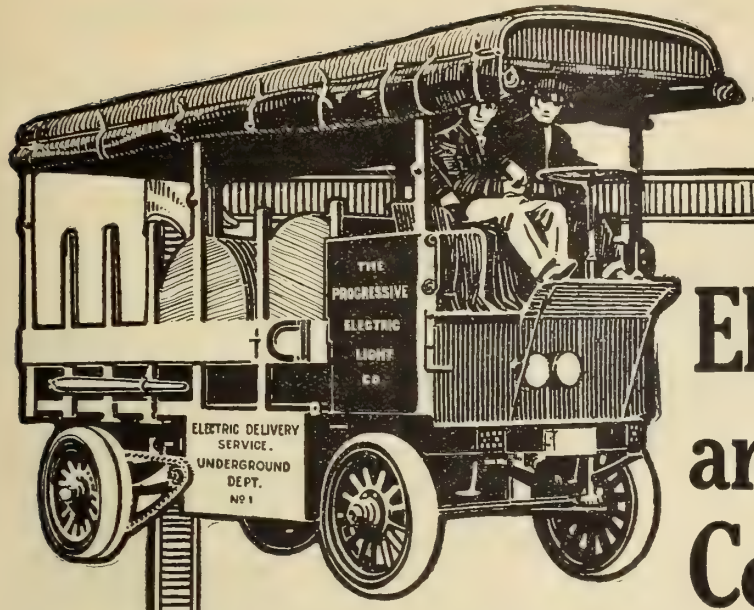
¶ The Grecian Lanterns and Canteloupe Ball Globes are made in five different sizes—illustrated in Moonstone Bulletin No. 1

¶ If you have not received our Moonstone Bulletin No. 1 be sure and write for it

The Jefferson Glass Company Limited

MADE IN CANADA

TORONTO CANADA



Electric Trucks are best for any Central Station

—most efficient and most economical

The Central Station that does not use Electric Trucks is overlooking a big factor for its own betterment. Electric Trucks are most perfectly adapted to the outdoor work of electric lighting companies. They are power plants on wheels—ready always to do their work cheaper, better and quicker than any other type of vehicle. Here are some of the uses to which any Central station can adopt Electric Trucks:

1. **General hauling of all kinds.**
2. **The hauling of heavy material, such as transformers, reels of cable, etc., in which the electric winch is indispensable.**
3. **The application of the electric vehicle in the construction of aerial lines, where electrically operated cranes are used for erecting or removing poles, transformers, etc.**
4. **The use of the electric vehicle in underground work for the drawing in and out of cable and pumping out of manholes.**
5. **The use of electric tower wagon for trimming of arc lamps, etc.**
6. **The adaptability of electric vehicle as an advertising medium.**

Small electric wagons are used by many companies for the delivery of lamps, meters, etc. These wagons are equipped with crates, etc., and have excellent advertising value as well as giving efficient, economical service.

Your use of Electric Trucks recommends them to others

Of course, you know the value of a vehicle charging business in making off-peak hours profitable. Why not boost Electric Vehicles with this end in view?

Once the vehicle users in your locality see that you have confidence in Electric Commercial Vehicles, it will be easy to induce them to follow your lead.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA

BOSTON NEW YORK: 124 W. 42nd St. (31) CHICAGO



BEST for everybody. It means more light and better light for the consumer, and increased business for the lighting companies and supply firms.

The light from a Sunbeam Mazda Lamp is steady, white and distinct.

Write for particulars, prices and dealer's Literature

Canadian Sunbeam Lamp Co., Limited

Main Office and Factory: TORONTO

BRANCH WAREHOUSES:

MONTREAL WINNIPEG CALGARY VANCOUVER



Plant of Standard Underground Cable Co., of Canada, Limited Hamilton, Ont.

The Price of Enduring Success

IT has been said that the first essential in winning success is "to deserve it." We believe that the way to deserve enduring success in our business is to render untiring service. Therefore, we decided to devote this space to telling what we have done and are doing to ***deserve*** your patronage,—namely:

Built Factories at Hamilton, Ont., which are the most modern and complete of their kind and which enable us to control every step in our manufacturing processes and thus guarantee uniform quality throughout our products.

Manufacturing a Complete line of Electric Wires and Cables for all classes of service, also Cable Terminals, Cable Junction Boxes and other Accessories.

Maintaining Branch Offices, with experienced salesmen, at points most convenient to our customers so that their requirements may be supplied with the least possible delay.

Maintaining large Stocks of raw and finished materials, thus insuring prompt filling of orders.

Maintaining a High Quality in everything we manufacture to the end that our customers may receive, not the ***cheapest*** products obtainable, but the most ***economical.*** That is products which, when durability and low maintenance cost are considered, are in the end far more profitable than those commonly called "cheap."

We have an attractive booklet giving full information about our various products and about "STANDARD SERVICE" which will be of value to you in your files. A request to our nearest office will bring your copy.

Standard Underground Cable Co. of Canada, Limited

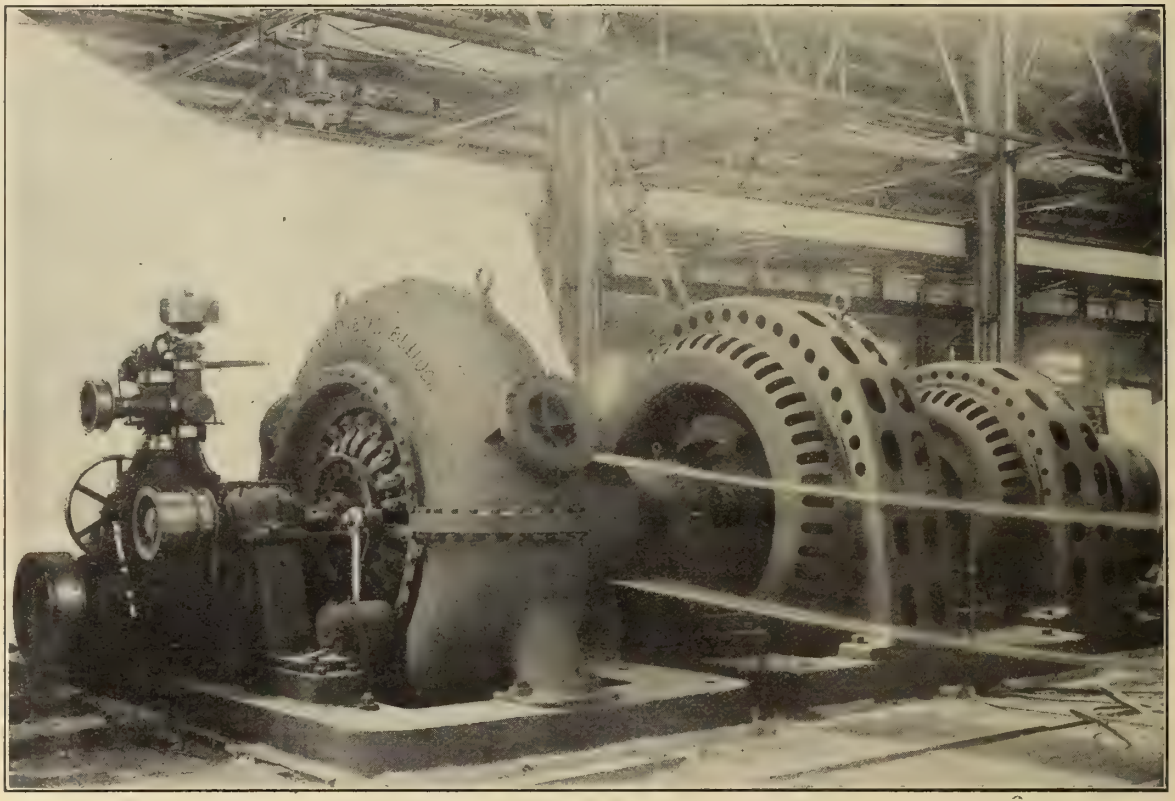
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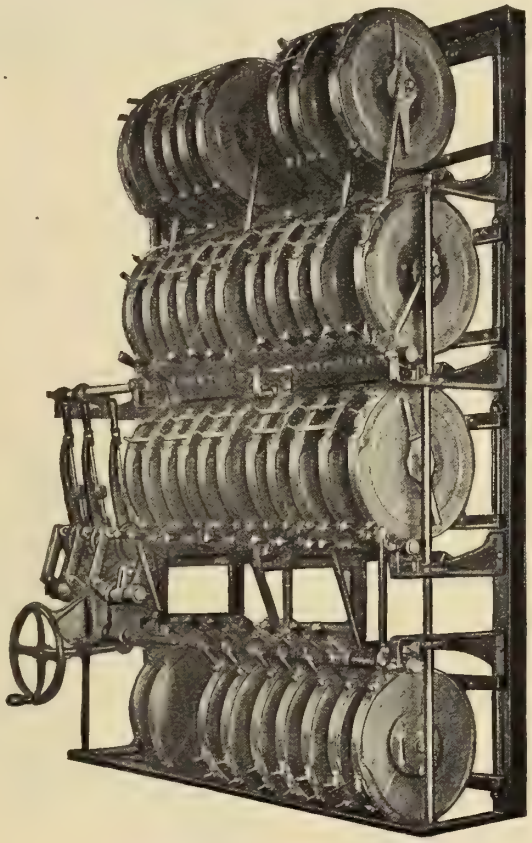
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New type "Simplicity" Dimmer Plates used.

A NEW DIMMER PLATE
For Tungsten Lamps

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The theaters are overhauling their electrical equipments now, so you better drop us a line for our Theater Dimmer Booklet which contains all the Bulletins on this subject.

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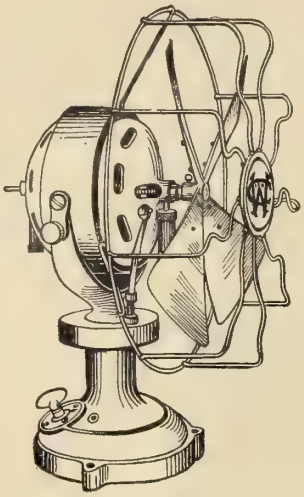
Academy of Music
Alhambra
American Music Hall
Astor
Berkley
Bijou
Bijou Dream
Broadway
Central Opera House
Central Theater Roof Garden
Geo. M. Cohan's Theater
Colonial
Columbia
Comedy
Criterion
Daly's
Delancey St. Theater
Eighty-Sixth St. Theater
Empire
Forty-Eighth Street Theater
Fox Tremont
Fulton
Gaiety
Garden
Garrick
Globe
Grand
Grand Opera House
Hudson
Irving Place
Keith's 14th Street
Keith's 23rd Street
Keith's 28th Street.
Keith's 58th Street
Keith's 125th Street
Knickerbocker
Lexington Avenue
Liberty
Lincoln Square
Little Theater
Loew's Circle
Loew's 30th Street
Loew's Seventh Avenue
Lyceum
Lyric
Madison Square
Manhattan
Manhattan Opera House
Maxine Elliott
Metropolis
Metropolitan Opera House
Miner's Bowery
Miner's Eighth Avenue
Murray Hill
New Amsterdam
New York
Olympic
Park Theater
Palace Theater
Republic
Savoy
Star
Third Avenue
Thirty-Ninth St. Theater
Tremont
Victoria
Wadsworth
Waldorf-Astoria
Weber's
West End
Winter Garden
Yorkville

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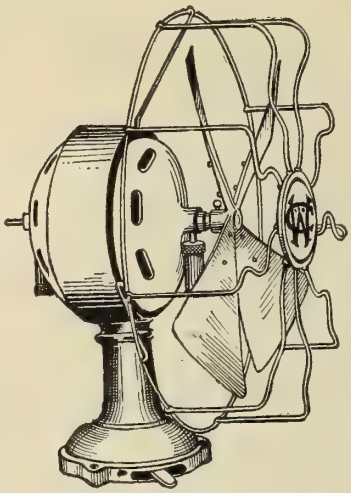
Academy of Music
Alhambra
Auditorium
Blackstone
Casino
Chicago Opera House
College
Colonial
Criterion
Crown
Empire
Empress
Englewood Masonic Temple
Fine Arts
Garrick
German
Haymarket
Hull House
Illinois
Illinois Athletic Club
Imperial
Indiana
La Salle
Little Theater
Lyric
Majestic
Marlowe
Masonic Temple
McVicker's
Medinah Temple
New Medinah Temple
Olympic
Orchestra Hall
Palace
Plaza
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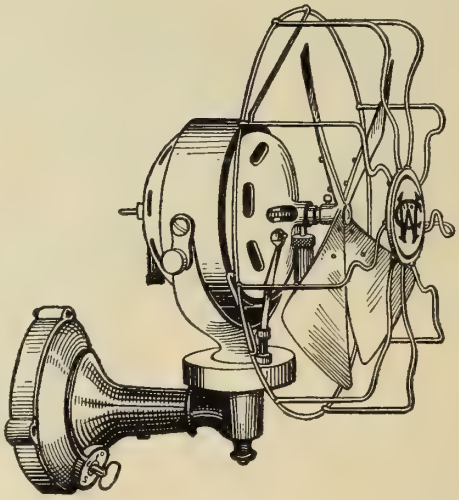


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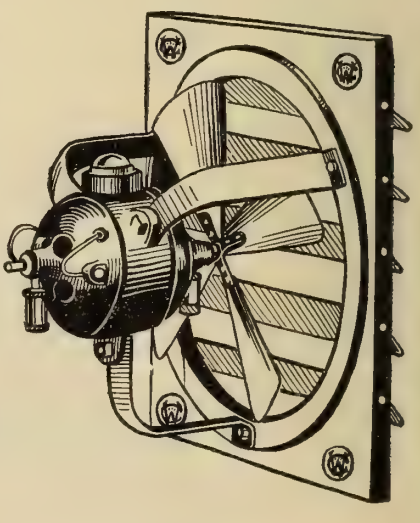


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C. & W. Fans produce a steady invigorating breeze and you can depend upon them giving your customers complete satisfaction. They are reliable and do not wear out in a season.

We have a complete stock in all sizes, in direct or alternating current motors, consisting of oscillating and stationary desk, wall and ceiling fans. The designs are neat and attractive, the workmanship perfect. They are noiseless in operation and superior in every way to any thing heretofore shown.

C. & W. Fans will be more popular than ever this season. If you have not already ordered, do so to-day.



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Standard doub'e truck "Near-Side" car.

represents the modern principles of efficiency applied to street car construction and operation.

Weight reduced to the lowest minimum consistent with safety and durability, the car shown above weighs 36,000 lbs. complete, ready for operation.

Seating capacity greatly increased with wider aisle space, and more seat space per passenger.

Cost reduced by the elimination of bulkheads, double end equipment, reversible seats, etc., yet a stronger and better finished car is provided.

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Comfort of passengers is promoted by their entering and leaving the car directly at the street cross-walk. Mud-wading and traffic-dodging is unnecessary.

Perfect ventilation and automatic heat regulation with other sanitative provisions meet the requirements of the most exacting Health boards.

The Near-Side Car Company owns patents covering all features of the "Near-Side Car and is prepared to grant licenses for the building and operation of new cars, or for the convertion of other types of equipment into "Near-Side" Cars and their operation under the Near-Side system.

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You can't help but admire its neat finish and, once tried on your lines your admiration will be just as great for its unfailing

Accuracy and Reliability

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The fine mechanical measuring apparatus embodies that delicate precision which can only be obtained by years of constant and careful experimenting. The most rigid testing and examination by expert engineers has failed to detect a single flaw.

C. & H. Meters start on exceptionally light loads and are particularly accurate on loads of long and contant duration.

C. & H. Meters are positively guaranteed from all defects in material or workmanship.

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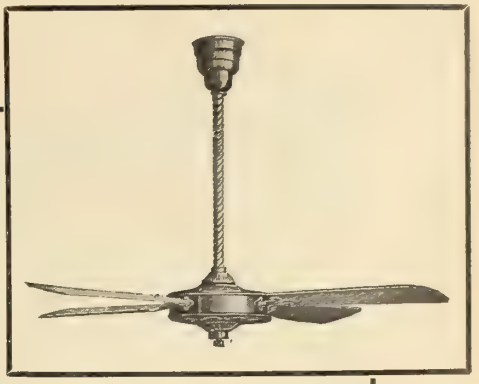
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A large and varied stock carried at our Winnipeg warehouse including

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- Cutouts
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is to ship standard supplies the day order is received



The Fan Motor Season is Here

The demand is great and must be met with immediate shipment from stock.

Can you meet it?

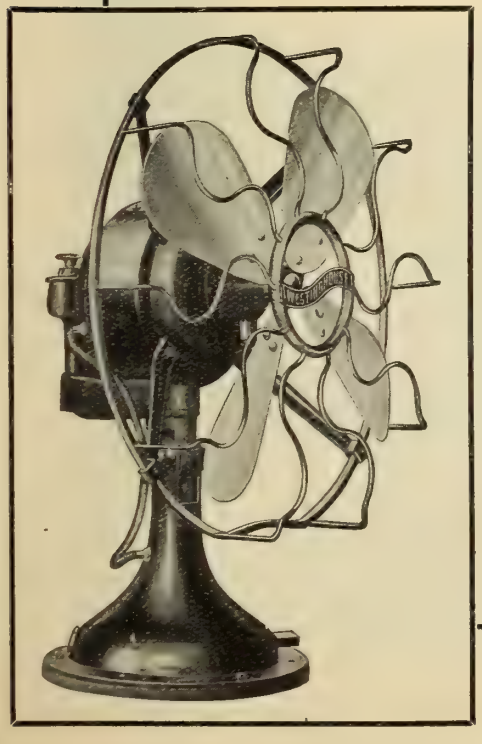
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Westinghouse Fans

are in splendid shape, but the orders are coming in rapidly.

Place your order now and avoid risk of being disappointed.

Don't let your customer go to your competitor for the fan you haven't in stock.



Westinghouse Fans have a reputation that makes particular people ask for them.

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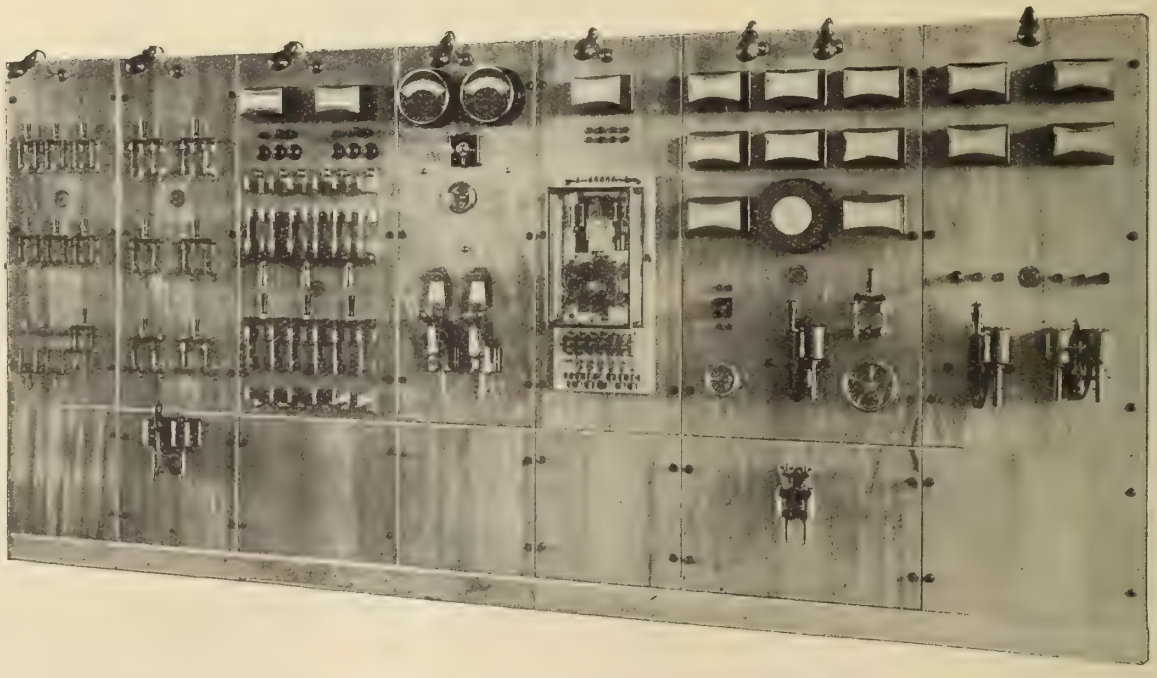
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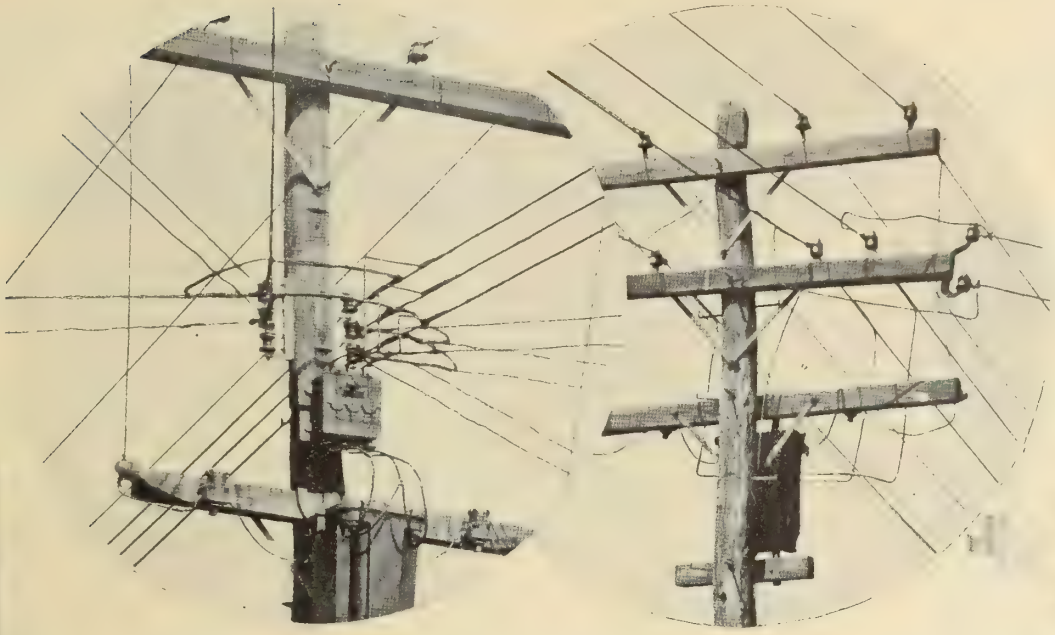


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Nothing too large or too small to interest us

We also make Sockets, Rosettes, Lamp Guards, Trolley Brackets, Special Transformers, Instrument Transformers, Etc., Etc.

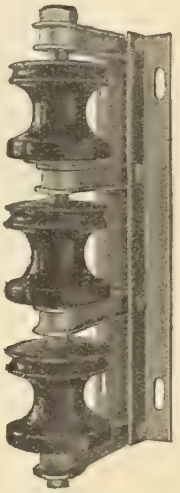
















The Old Horizontal System of Distribution

is Due for a Total Eclipse

It involves expensive, unsatisfactory crossing of wires and heavy up-keep expense. It crowds the pole with only a few service connections, and it looks ragged. If you want to save first cost and maintenance cost, adopt

Vertical Distribution with Peirce Secondary Racks

You will reduce inductive drop, because the wires can be strung close together without danger of touching. You will get uniform sag—you will avoid crossing of wires. You will get greater strength at lower first cost and negligible maintenance cost.

If you figure in everything from first cost to interest and depreciation, you'll find the saving amounts to nearly 85 per cent.

Remember that Peirce Secondary Racks are backed by the Hubbard Guarantee, which knows no time limit.

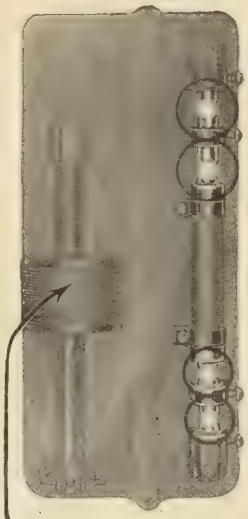
Peirce specialties and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.

The Hardware MAKES the Line
Hubbard Makes THE Hardware

Hubbard and Company

Pittsburgh, U. S. A.

If These Arcs Hold, Your Line Is Grounded or "Shorted"—



This Circuit Breaker Prevents It

You can't secure the elimination of lightning arrester grounds and short circuits on your lines, unless you use arresters having a **positive means** for cutting off the flow of line current following the lightning discharge to ground.

Most arresters depend on air gaps alone for doing this; but air gaps **alone** won't cut it off positively at all times. It will at times be too heavy, the arcs will hold at the gaps, ground or "short" your lines, blow your fuses, cripple your service.

The **one positive means** that you can use, and the **only** positive means, is the circuit breaker of the Garton-Daniels Arrester; it operates just as surely as if you opened a hand-operated switch in the arrester circuit from line to ground.

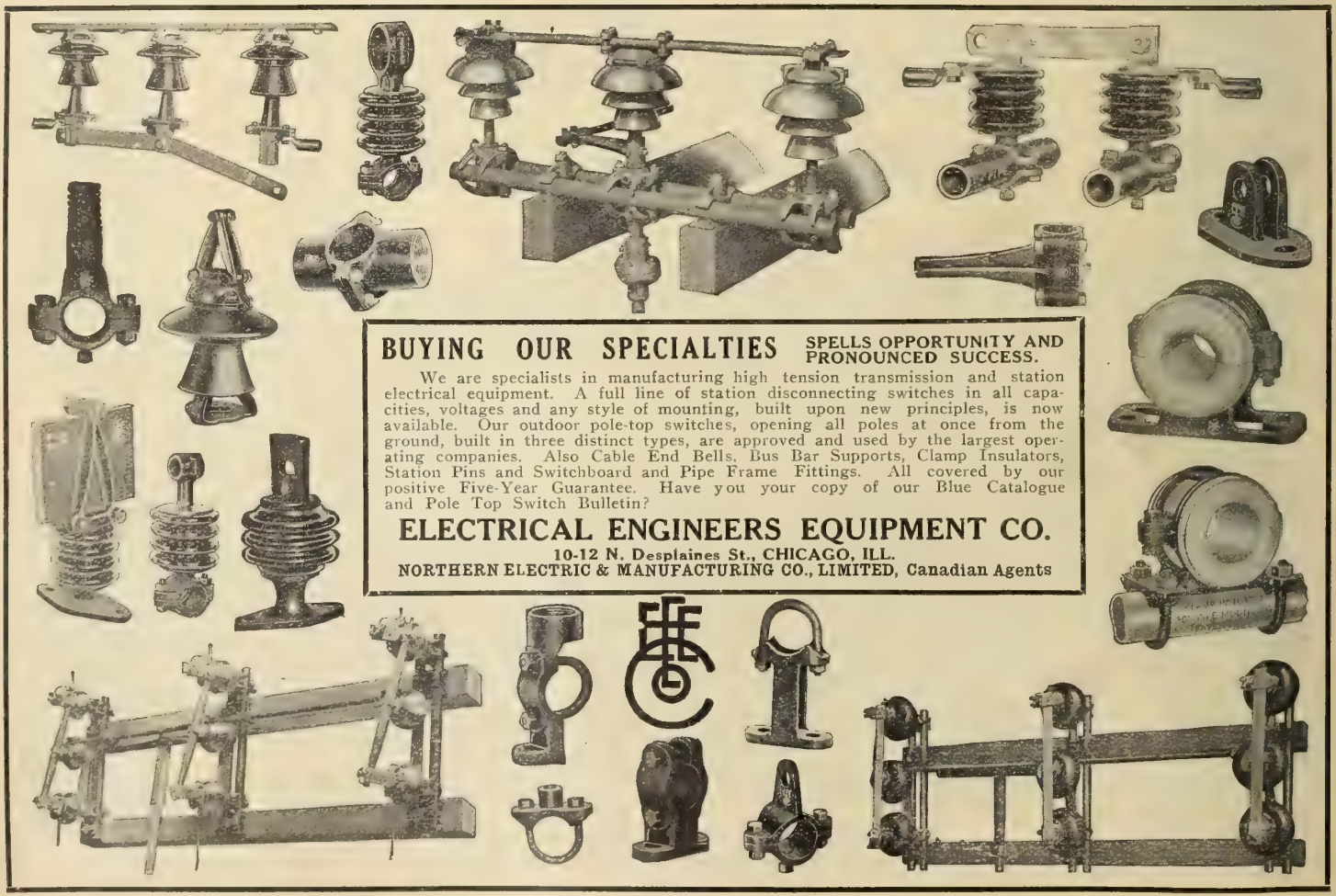
Its cut-off is **positive,** and this positive cut-off means freedom from grounds and short circuits on your lines.

It is because of the circuit breaker **combined** with small air gap distance for efficient protection and low series resistance for eliminating surges, low voltages and similar disturbances, that the Garton-Daniels Lightning Arrester **alone** will give you "Complete" Lightning Protection.

Isn't a "Complete" Arrester the kind you want to use?

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Electrical News
Generation, Transmission and Application of Electricity

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Vol. 22 Toronto, July 1, 1913 No. 13

The Convention

Canadian electrical men have reason to be proud of their 23rd Annual Convention not only in point of attendance, but in that the program, both from an intellectual and entertainment point of view, was one of the best that has ever been prepared for such an occasion. The papers were uniformly excellent and in nearly every case brought out a quantity of spirited and very helpful discussions. It is a fact, however, that the time at the disposal of the delegates does not allow them to discuss the various problems as thoroughly as they could wish. It would appear either that the number of papers should be reduced or, that the duration of the convention should be lengthened, for there can be no question but that the most valuable part of any paper is the discussion which follows it. It is open to question if the object of the convention might not be made rather the discussion of papers than the mere reading of them. It does seem a mistake to bring delegates from Winnipeg or Vancouver or Halifax to hear an author read a paper to them when in the same length of time they could read it themselves, before they started, if it were in their hands. What appears to the writer as the legitimate object of such an association is the exchange of the points of view of the different operating men, the paper being taken as the basis on which to build up an amount of useful practical information.

The suggestion is thrown out that if these papers were prepared a little in advance of the convention so that they may be in the hands of electrical men all over Canada, say two weeks before the convention date, the result of such a course should be two-fold,—first, that a delegate would read the particular papers, carefully, in which he is most interested, and would prepare himself between that date and the convention to take part in the discussion, ask questions and express his own point of view or the results of his own experience. The other advantage would be that many men who may not have an early intention of attending the convention might become interested in the subjects brought forward by these papers to such an extent that they would feel called upon to attend the convention, hear the point of view of many other men operating under conditions similar to their own and probably take a hand in the discussion themselves. Such a course also would make it possible for a number of delegates, who may not have sufficient confidence in their own oratorical powers to get on their feet and make an impromptu speech, to prepare their statements in written form. This would have the further added advantage that copies of these questions or points of view might be handed in to the author of the paper, who would thus be prepared beforehand to deal with these questions in a much more comprehensive way than he is often able to do on the spur of the moment.

There was undoubtedly a considerable amount of disappointment on the part of municipal ownership men that the question of enlarging the scope of the association did not receive more favorable consideration. The information gathered by the executive and embodied in a report showed a strong feeling in favor of such a change and the talk around the lobbies was in much the same vein. The advocates of reorganization were, however, apparently unprepared to take a decided stand in the matter, being unwilling to commit themselves to any change for which the time might not be ripe. All were agreed that the present arrangements were better not disturbed unless there were a reasonable and almost absolute guarantee of the success of a new association. As a result the question is ostensibly shelved for another year. The feeling of the private companies is decidedly and, naturally, strongly in favor of continuing their close relation with the N.E.L.A. This is not at all to be wondered at in view of the very valuable work this association has done and the immense amount of information it has collected and placed at the disposal of its members. On the other hand, municipal men have no similar source of information and feel the need of an electrical organization which may well be formulated with an object in many ways similar to the N. E. L. A., excepting, of course, that its membership would be entirely general. The suggestion of Mr. Dion that the possible solution of the difficulty lay by way of the private companies relinquishing the name, The Canadian Electrical Association, and still retaining their connection with the N. E. L. A., appears to be the best in sight. This would open the way for the organization of a Canadian electrical association to include all electrical men, but would not deprive the private companies of the advantage at present received from the affiliation. That something will be done along this line within the next few months appears probable at the present moment.

Auxiliary Plants

The inevitable has happened—the transmission line of the Hydro-electric Power Commission of Ontario, with its manifold factors of safety has in its turn been put out of commission by adverse atmospheric conditions,—unfortunately for two periods of several hours duration each. We do not believe this has been a matter to cause any satisfaction to even the worst enemies of municipal ownership, but it is rather an experience from which all should profit—it seems an unanswerable argument in favor of auxiliary equipment for every generating plant serving a manufacturing district. The financial loss to a manufacturer during a pro-

longed shut-down is very great, and when we try to calculate the total loss, direct and indirect, over the immense area served by the Ontario Commission, it is evident that the amount soon becomes comparable with the cost of installation of the necessary auxiliary plants. Such auxiliary plants are also very valuable in keeping down the peak load, which forms the basis on which payment for energy is generally made. Added to this, there is the certain feeling in the minds of customers of any system that has once failed, that the same thing will likely happen again, and this makes it more difficult to take on new customers or increase the load of the old ones. Undoubtedly the best advertisement a distributing system can have is an unbroken record for uninterrupted service.

The Ontario Commission's line has been so well constructed, it has scarcely been criticised. The simultaneous failure of two circuits so splendidly designed as these were, and at the same time so thoroughly isolated from one another only means that no single source of power can give the guarantee demanded by modern commercial life. This mishap also indicates the direction in which the greatest need lies for engineering, ingenuity and improvements—the perfection of apparatus to prevent disturbances on transmission lines. The various so-called lightning protection devices in such cases simply do not protect. Whether electrical engineering knowledge will ever, in the distant future, reach that point of perfection where all the vagaries of the lightning flash can be foreseen and guarded against, only the future can say, but in the meantime it is evident that continuous service can be had only at the price of a duplicating plant of one kind or another.

Electric Vehicle Association

The Publicity Committee of the Electric Vehicle Association of America through its chairman, Mr. Frank W. Smith, reports splendid progress in the work of the committee soliciting funds to carry forward for another and second year the National Co-Operative Publicity Campaign to promote the use and adoption of the electric pleasure and commercial vehicle. As already reported in these columns, this Association is doing splendid work for the electric vehicle industry. The membership of the association shows a very healthy growth.

The fifth annual convention of the association will be held during October 27-28. The Publicity Committee announces a total amount so far pledged as approximating $35,000, and is making a final plea so as to bring the amount to at least the sum expended for the first year. A special appeal has been made to the central station interests, a final plea being in the form of a very attractive circular and return stamped post card to those central stations which have not already subscribed asking that every company contribute a "booster" or "good will" contribution of at least something. The return post card is arranged so that the amount of subscription may be indicated by a check opposite the printed figures, this being the only action necessary on the part of the contributor as the return post cards are serially numbered, which number identifies the subscriber. It is only necessary to indicate by check opposite the amount to be subscribed and drop the card in a box, the association will do the rest.

A Correction

In an article appearing in our June 15th issue on "The Growing use of Electricity on Farms," the first paragraph under the sub-head "Actual Installations," line 13, is made to say "a load of 2 h.p. to the mile"; this is a typographical error and should read "a load of 8 h.p. to the mile," to correspond with the statement made in the last line of the article.

Storage Batteries for Small Towns

The corporation of Yellowgrass, Sask., have recently added to their generating equipment a storage battery of 60 cells with a capacity of 1200 amp. hours. This is in connection with a 17 kw. generator driven by a 25 h.p. gasoline engine which the town installed some 2 years ago in connection with their water system. The storage battery has been in operation about two months, and in that time it has been demonstrated that the engine is only required to operate about three hours a day to charge the battery and a little longer on Saturdays to provide for the Sunday load. The cost of the whole plant including three miles of pole line, street lamps and the necessary house meters, was $10,300. The battery was installed by the Accumulator Lighting Company of Winnipeg.

Mayor Allen of Yellowgrass has stated that the storage battery lighting plant is giving perfect satisfaction and that he recommends a similar installation to any town requiring a lighting plant. One of the outstanding advantages of such a system is the availability of a twenty-four hour service, the lack of which causes great inconvenience in towns where only a limited hour service is supplied.

Campbell River Power Company

The importance of Vancouver Island as a field for the development of electrical energy on a large scale has long been recognized, and the confirmation of a report to the effect that the Campbell River Power Company of Victoria has plans under way for the establishment of a gigantic hydro-electric project on Campbell River, at the northeastern portion of the Island, will no doubt arouse a great deal of interest in electrical circles throughout the Dominion. According to the limited information at present available, the plans of the company involve an ultimate expenditure of approximately $12,000,000 on the development of 300,000 horse power from the waters of the three falls of the Campbell River at a higher voltage than any existing power plant in British Columbia.

A corps of engineers is now engaged in detail surveys and estimates, and as water rights and incorporation have already been secured, a start on the plant is anticipated as soon as the estimates are in hand—probably some time during the coming summer.

It is the intention of the company to sell electrical energy all through Vancouver Island. Mr. George C. Hinton, of the Hinton Electrical Company, Vancouver and Victoria, is one of the promoters of the new company. It is understood that arrangements have been made to secure ample capital for the enterprise from English sources.

Street Lighting in South Vancouver

The question of an ample, efficient and economical system of electric lighting and power for South Vancouver was introduced at a recent meeting of the council, when Mr. L. F. Rawden, municipal electrician, made a report as to the cost of such in the municipality compared with several cities in the Dominion. As the cost of street lighting alone is not so efficient or so economical as it might be in South Vancouver, the comparative figures given were of sufficient interest to merit serious consideration. The matter of an adequate street lighting and power system is not only of particular interest to residents, but also to manufacturers to whom cheap power is essential to successful production. This latter desideratum is of special importance to municipalities desiring to induce industries to locate in their district.

In the course of Mr. Rawden's report it is stated: that last year the municipality paid $13,400 for street lighting alone for half-night service of about 300 lamps, and this

year over 600 lamps are burning at an estimated cost of $25,000. In the event of the council insisting on an all-night service this winter as was the case last year, the electrician pointed out that this lighting estimate would be exceeded. The present municipal contract has seven years to run. On investigating other municipal lighting systems and from his own personal experience, Mr. Rawden claimed that the municipality could operate a street lighting plant and give a much lower rate provided the council would install a plant to supply incandescent lighting for householders and power for manufacturers. The latter would encourage the establishment of industries in the district and would offset the cost of street lighting. The members of the council were favorably impressed with the idea, and instructed the electrician to prepare a report on the cost of providing an electric plant for supplying incandescent lighting in the municipality.

Vancouver's Electric Truck Garage

The British Columbia Electric Railway Company, Limited, has recently advanced the prospects of the electric vehicle business in Vancouver by opening a fully equipped garage for this type of equipment, view of the interior of which is shown on this page.

The chief object of the company in arranging for this garage is to accommodate the demands of owners of commercial trucks, the sale of which the company is now pressing vigorously. It is the intention to leave the business of caring for electric pleasure cars to the owners of private garages, a number of these establishments in Vancouver being equipped for this purpose.

The B. C. Electric garage is located in the heart of the business district, thus being convenient for the firms operating electric trucks. The floor space for the vehicles is 90 x 170 feet, which will permit of the accommodation of from 50 to 60 cars, according to size. Located to advantage on the ground floor are the offices of the superintendent of the station and another compartment for battery room and workshop. On the upper floor is a large room for storage, where spare parts, etc., are kept.

The electrical equipment consists of a d.c. motor generator set of 75 k.w. capacity, with an emergency set consisting of a 50 h.p. motor belted to a 45 k.w. generator. A complete switchboard apparatus and necessary equipment for charging is also provided. All the charging lines are laid in conduit under the cement floors.

At the present time about 15 cars are taken care of at the garage. The service given consists of the storage of the car, daily washing and oiling, charging of batteries as needed (this work being done, as usual, at night although the firms are urged to have their men look after their cars and have the batteries "boosted" at noon if there is need) and the making of minor adjustments and repairs. The force now employed at the garage consists of a superintendent, three operators and a washer. The rates charged for the services noted above are as follows:—

Cars 750 and 1000 lbs	$45 per month
1 tone trucks	55 per month
2 ton trucks	60 per month
3½ ton trucks	65 per month
5 ton trucks	70 per month

The usual charge for the keep of electrical pleasure cars at Vancouver garages is from $30 to $35 per month, the garages sometimes offering in connection with the services the calling for and delivery of the cars.

The B. C. Electric has done good missionary work this year in the introduction of electric commercial trucks in Vancouver. As soon as it was decided to take up an agency an experienced man was engaged who was acquainted with both the selling and garage ends of the business. An advertising campaign was conducted through the daily press, circular letters, pages in auto magazines, etc., which aroused keen interest in the business. As the firm operates a number of electric trucks in its own business, the "prospect" was usually given the opportunity of testing out a car in a day's work at his particular form of business, this form of canvassing being very telling in results. Since spring, two hotel busses have been sold, each of 1 ton, a 2-ton truck to a wholesale fruit firm, a 2-ton truck to a wholesale hardware firm, a 1-ton truck to another hardware firm, and three trucks, ranging from 750 lbs. to 3½ tons have been taken by the company for its own business. Through other dealers another 2-ton truck has been secured by a wholesale milling firm which made the purchase after a year's trial of an electrical truck at another point on the coast. The company's representative reports that keen interest is being taken in the operation of electric trucks and that his "prospects" are numerous, the indication being that a good business will be done in the near future.

Montreal Electrical Association

Mr. P. T. Davies presided at the annual meeting of the Montreal Electrical Society held on June 6th at the Edin-



B. C. E. R. Garage for electric vehicles, Vancouver.

burgh Cafe. The reports submitted and the speeches made show that the society has more than fulfilled the expectations of the founders, the membership now numbering 375. In his opening address Mr. Davies spoke of the harmonious working of the executive committee, and the aid received from the various sections of the society. He suggested that the membership was now sufficiently large to warrant the renting of permanent quarters while it was also possible that in the near future educational classes, as distinct from the ordinary meetings, would be held. Mr. J. C. Bray, secretary, and Mr. W. H. Tees, treasurer, submitted their reports, which were adopted, and votes of thanks were passed to the officers. It was stated that the treasurer had a balance in hand of about $100.

The following officers were elected: president, T. H. Nicholson; vice-president, T. N. White; secretary, J. C. Bray; treasurer, W. H. Tees. The executive board is composed as follows: Traction, J. M. Mochon; telephone and telegraph, W. H. Winter; power, W. J. B. Drew; construction, T. E. Salter; manufacturing, L. E. Hamilton; contracting, U. A. Luduc; commercial, H. L. Etienne.

New Barracks Tenders Called

Tenders have been received in connection with the erection of the new barracks at Long Branch, 10 miles west of Toronto. The specifications indicate in detail the electrical requirements which are chiefly for lighting and motor purposes. The extent of the lighting requirements may be judged from the following list:—

671 single light fixtures, with 60 watt lamps.
16 single light fixtures, with 100 watt lamps.
8 single light fixtures, with 150 watt lamps.
23 three-light chandeliers, with 60 watt lamps.
23 five-light chandeliers, with 60 watt lamps.
37 ceiling balls, each with one 60 watt lamp.
6 brackets with single lamp, 60 watts.
38 brackets with single lamp, 25 watts.
13 plug receptacles.
3 floor outlet boxes.
4 single light fixtures, with 60 watt lamps to be used at boilers.
592 push button switches.
2 three-way switches.
22 panels for lighting.
4 panels for power.

The motors are principally for ventilation purposes, which will require fourteen on the 3rd floor, each from 2 to 2½ h.p. capacity. There will also be two 3 h.p. motors for ventilating fans on the basement floor, two 5 h.p. motors for sump pumps and two electric air line pumps requiring a 1 h.p. motor each.

All wires will be distributed in conduit, the lighting distribution being 3-phase, 110 volts with single phase, 110 volt branches.

The committee of the International Engineering Congress have effected a permanent organization with Prof. Wm. F. Durand, as chairman, and W. A. Cattell as secretary-treasurer, and have established executive offices in the Foxcroft Building, 68 Post Street, San Francisco.

Pacific Coast Convention A. I. E. E.

In connection with the Pacific Coast convention of the American Institute of Electrical Engineers to be held in Vancouver, B.C., September 9, 10, 11, the following committees have been appointed:—

General Committee: R. F. Hayward, chairman; E. M. Breed, secretary; F. D. Nims; D. P. Roberts; J. R. Read.

Papers Committee: Messrs. F. D. Nims, chairman; D. P. Roberts; W. W. Fraser.

Transportation Committee: Messrs. E. M. Breed, chairman; J. R. Read; J. Montgomery; E. R. Pease; H. N. Keifer.

Entertainment and Reception: Messrs. L. G. Robinson, chairman; R. H. Sperling, J. Shand, W. V. Hunt, G. R. Wright, W. J. Lister, C. M. Beebe.

Finance Committee: Mr. E. McNeil.

The Papers Committee have tentatively arranged a program of seven papers, including one paper to be presented in the evening as an illustrated lecture. It is proposed to present only one paper each session so as to give more ample opportunity for comprehensive discussion.

Following the regular business of the convention, two trips are being arranged, one to the plant of the Western Canada Power Company, Stave Falls, and the other to the plant of the Vancouver Power Company, at Lake Buntzen.

Telephone Institute Formed at the Coast

Organization was recently completed of the Telephone Institute of British Columbia, formed in connection with the B. C. Telephone Company, Vancouver. The object of the Institute is to enable the heads and principals of departments to get together for the discussion of matters in which the different departments act in conjunction, so that full knowledge of important subjects under consideration may be possessed by all. The membership was enrolled complete at thirty-seven.

Meetings will be held on the first Monday of each month. At the next meeting Mr. E. P. Labelle, plant engineer, will give a paper on the new cable which was laid last month.

Pringle vs. Canadian Moloney Company

Application for hearing has been made in the High Court of Justice, Ontario, between R. E. T. Pringle, plaintiff, and the Canadian Moloney Electric Company, Limited, defendant, in the matter of certain claims in connection with the winding up of a previous partnership. The plaintiff claims:

(1) That an account be taken of all orders obtained by the plaintiff from customers in Canada from the 1st July, 1911, to 31st December, 1912, and also of all orders obtained by the plaintiff for the defendant from the 1st of January, 1913, to 31st March, 1913, and accepted by the defendant and of the amount commission due to the plaintiff in respect thereof.

(2) That an account be taken of the amount due by the defendant to the plaintiff in respect of commission as general manager of the defendant company from the 1st of July, 1911, to 31st December, 1912.

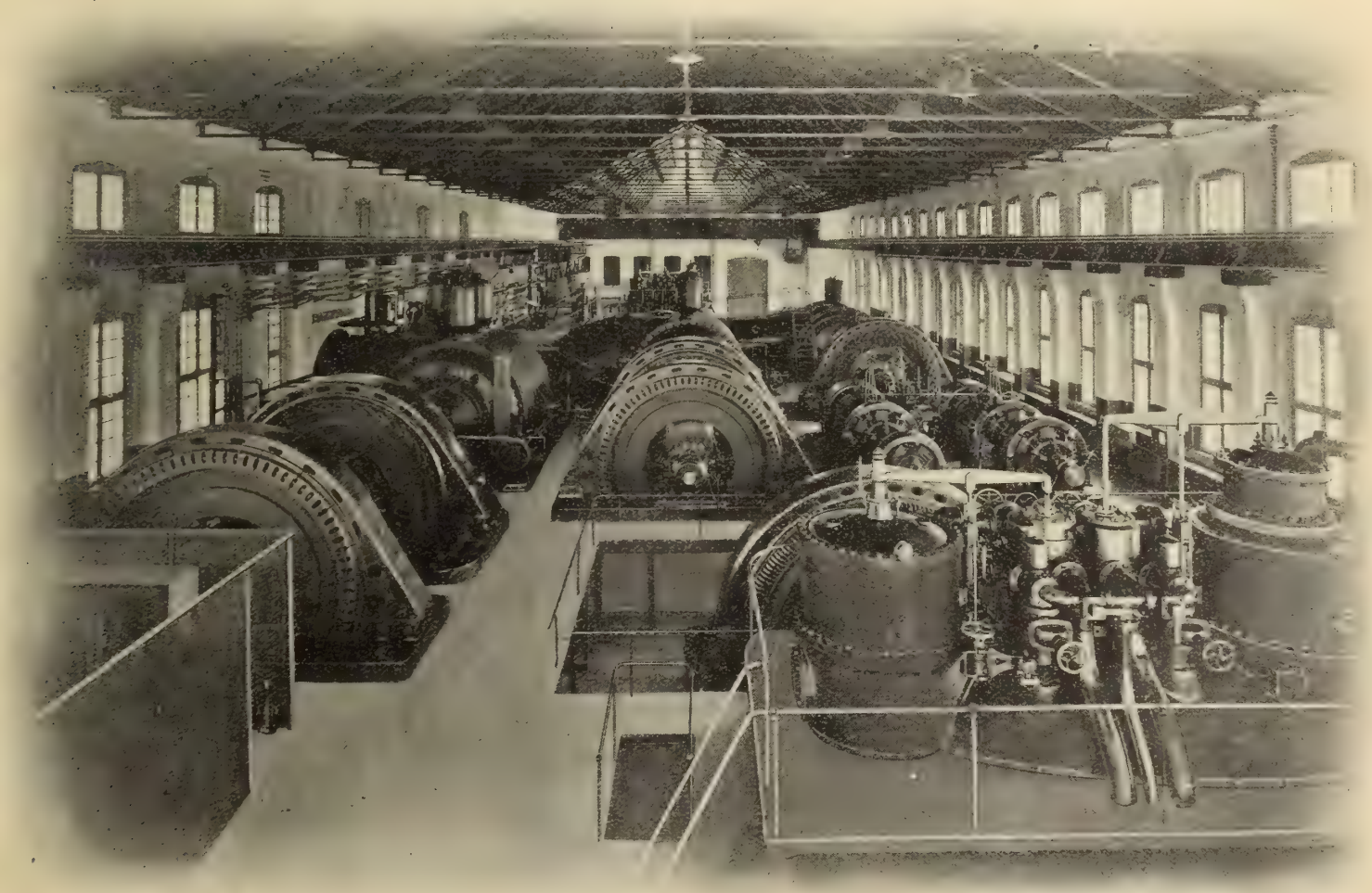
(3) Payment by the defendant to the plaintiff of the amount found due to the plaintiff on the taking of such accounts.

Shawinigan Water & Power Company

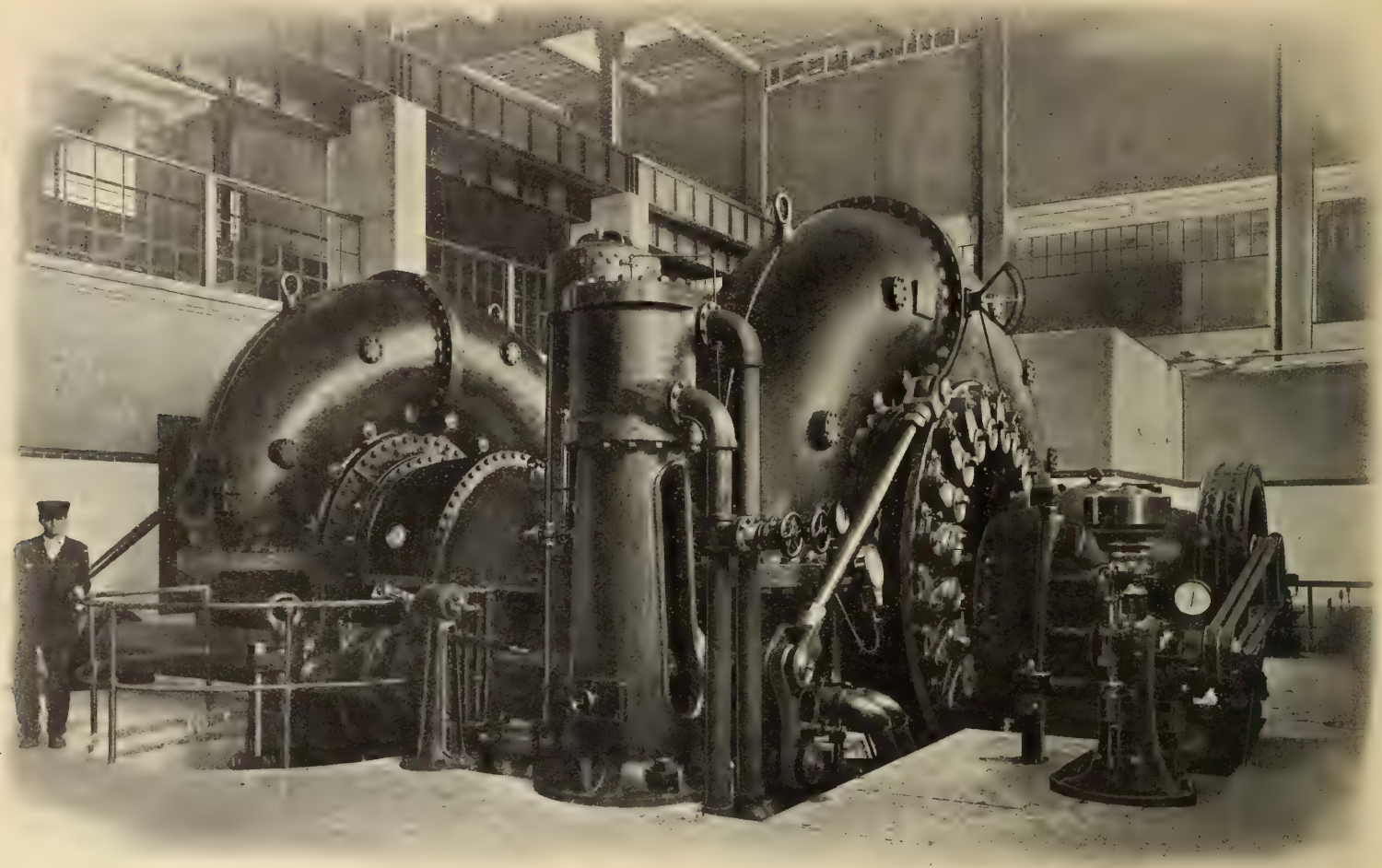
The illustrations on the two following pages show the magnificent developments at Shawinigan Falls of the Shawinigan Water & Power Company. It will be remembered that the capacity of power house No. 1 consists of six turbine units, three of 9,000 h.p. and three of 10,500 h.p. each, giving a total capacity of 58,500 h.p. The generators are 2-phase, 30 cycles, 2200 volts.

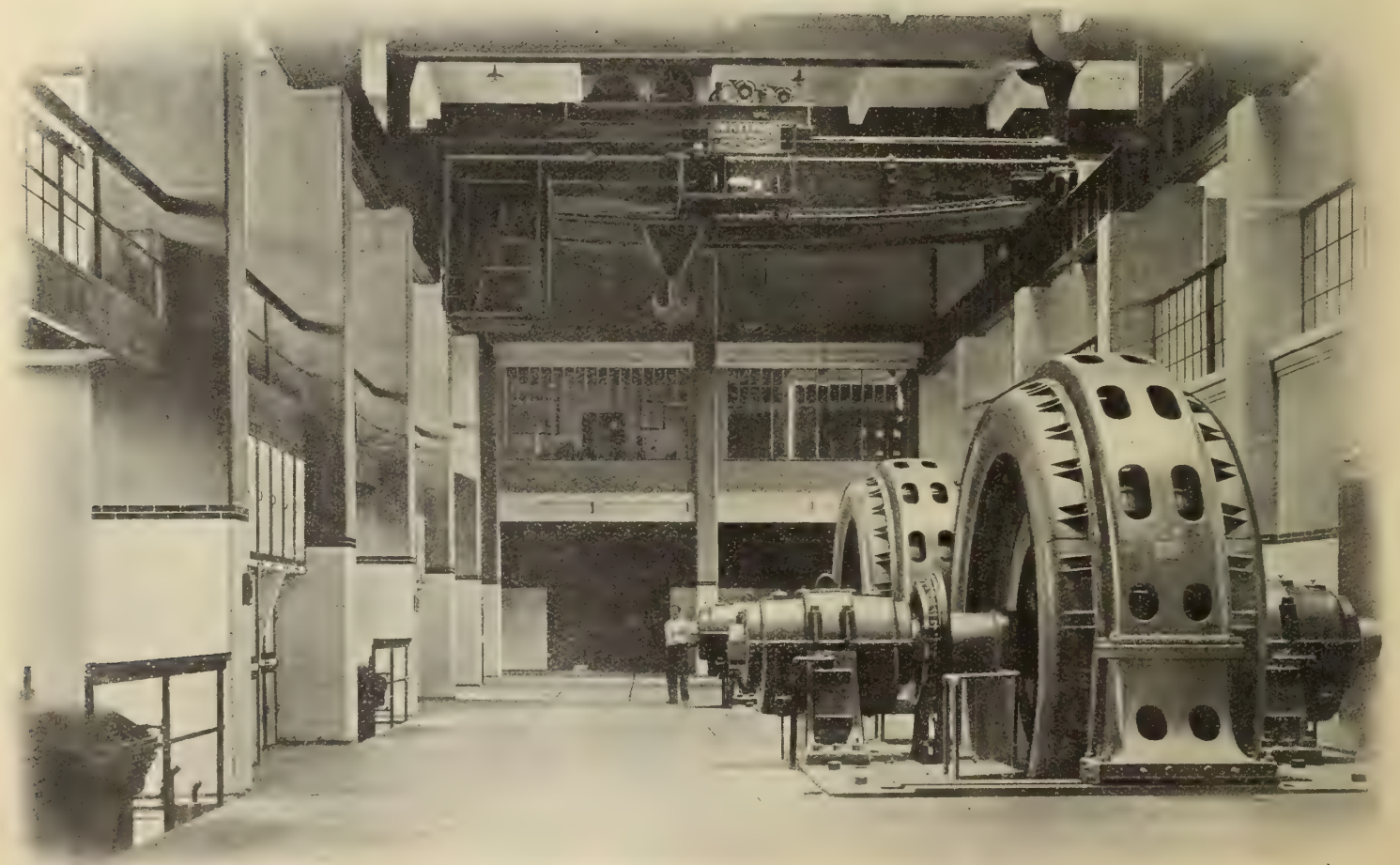
The layout of power house No. 2, when completed, will be such that there will be five units each with a normal rated electrical capacity of 16,000 h.p. or a total of 80,000 h.p. The general scheme of this layout is to divide the power station into two divisions, each consisting of two units with the third unit in the centre, which will be considered as a spare. Generation in power house No. 2 is 3-phase, 60 cycles, 6600 volts, which is raised to 100,000 volts for transmission.





Shawinigan Water and Power Company. Upper figure shows both power developments; lower figure shows interior of power house No. 1.





Shawinigan Water and Power Company, Power House No. 2; upper figure shows 18,000 h. p. double turbine; lower figure two 15,000 kw. generators

Canadian Electrical Association Convention

A Splendid Collection of Papers—Lively Discussions, Especially on Commercial Topics—An Enjoyable Entertainment Program.

The 23rd annual convention of the Canadian Electrical Association was held in Toronto at the Chemistry & Mining building of the University of Toronto on Wednesday, Thursday and Friday, June 25, 26 and 27. In point of good attendance and enthusiasm there has been no more satisfactory convention in the history of the Association. Mr. W. L. Bird, the superintendent of the Kaministiquia Power Company, Fort William, this year's president, made a very acceptable master of ceremonies, and by his timely remarks succeeded in keeping the discussions at a high state of enthusiasm during the entire period of the convention proceedings. Mr. Bird's opening address, though brief, was a careful review of the electrical situation at the present time, covering the developments of the past year and indicating the direction along which improvements may be expected in the near future.

Reorganization

At the end of the morning session of the second day of the convention the question of re-organization of the Canadian Electrical Association was introduced by the president, Mr. Bird, who called for a report on the returns from certain enquiries that had been sent out a few weeks before to ascertain the opinions of electrical men. The report explained that at the request of the executive committee of the association some 1,000 cards had been sent out requesting an opinion on the advisability of a re-organization of the present association on broader lines and so as to include also, among others, the men who are employed by municipal electric plants. The report explained that the answers had been somewhat fewer in number than could have been hoped, largely due, probably, to the fact that the queries sent out had, of necessity, been made more or less indefinite. The report showed, however, that, summing up the votes that had been returned, the majority was vastly in favor of re-organization, in the ratio of about 4 to 1.

Following the reading of the report a spirited discussion followed, in which Messrs. Lambe, Philip, Moore, Gould, Dion and others took part. Mr. Lambe favored the re-organization on such a basis as would include himself, for example, and numerous other men he knew of who were not eligible under his present constitution. Mr. Philip was in the position of a man who had formerly been associated with a private company, and as such had been in favor of including only private companies in this organization. Under his present circumstances, as superintendent of a municipal plant he felt that there was no real reason why he was not still eligible to the same Canadian Electrical Association, and he thought it was only reasonable to ask that the scope of the present organization should be enlarged so that men in the same position as himself might be included. He was confident that he spoke for a large number of the men situated similarly. Mr. Gould, while representing a private company and acknowledging the value of the National Electric Light Association with which he said he would not care, under any circumstances, to sever his connection, was also strongly of the opinion that an association broad enough to include all electrical men in Canada was much needed today. Mr. Moore spoke along the same lines.

Mr. Dion, as an advocate of retaining the present arrangement, replied to the above speakers. He recognized the point of view of every one of them, and in doing so, stated that under similar circumstances he had little doubt that his views would coincide with theirs. He was in the position, however, of being associated with a private company. If the Canadian Electrical Association was to be carried on as a business organization where the heads of departments could meet and discuss methods of management, etc., he was strongly against any change in the present order of things. Mr. Dion counselled caution and delay lest a new association might be formed under circumstances that would not give sufficient guarantee of its success. He also drew attention to the great value of the connection with the National Electric Light Association and stated that under any circumstances his company could not afford to relinquish that connection. He threw out one suggestion—the possibility that perhaps the private companies which at present constitute the Canadian Electric Association might think well of relinquishing that name and still retain their connection with the N.E.L.A. under, possibly, a new name. This would then leave the field open for the formation of an association along the lines that seemed to be favored by a number of those present. Mr. Dion, however, believed it would be best to let the matter stand over for a time until all the delegates would have a chance of crystallizing their points of view. This would be more readily possible after listening to the discussions.

At a subsequent meeting of the Executive Section following the general discussion, it was decided to make no change in the constitution at the present time.

New Officers

The new officers of the association were elected as follows: president, Col. D. R. Street; first vice-president, Mr. A. L. Mudge; second vice-president, Mr. D. H. McDougal; executive committee, A. A. Dion, R. J. Smith, W. L. Bird, A. E. Dunlop, M.P., W. S. Robertson, R. H. Sperling, W. G. Angus, R. B. McDunnough, L. W. Pratt, H. G. Matthews, F. G. Clark, R. M. Wilson, James Gould and E. L. Milliken. Secretary-treasurer, Mr. H. G. Martin.

The Papers

A brief resume of each of the papers and of the discussions which followed are given below. Future issues of the Electrical News will contain a number of the papers in full.

GRAPHIC METERS

By G. D. Gratton.

This paper outlines the general principles underlying the construction and operation of graphic meters and refers at some length to their operation, maintenance and testing under the following heads: paper or chart speed; scale capacity; performance; repairs and maintenance; cost of operation; testing and records.

The principle of a graphic meter is the same as that of the Kelvin balance, Siemens dynamometer, the Moving Iron, the Induction, and the D'Arsonval instruments. The paper classifies graphic meters under two heads, the relay type and the direct acting type. In the relay type the measuring element does not do the work of operating the pen but closes a set of auxiliary contacts which in turn closes the circuit through relay coils that operate the pen. This keeps the pen friction independent of the measuring element and tends towards greater and longer accuracy, due partly to the fact that lighter moving elements can be used. Also the instruments do not require so much power to operate them.

In the direct acting type the measuring element operates

the pen directly on the chart so that the moving coils are obliged to have a large torque in order to overcome the pen friction, etc. This means a high shunt loss and in some cases a heavy moving element. In this type it is found that unless the instrument is very carefully adjusted the pen does not follow the fluctuations accurately.

As indicating the relative losses in these two types of meter the paper quotes one make of the direct acting type showing a consumption of 200 watts as compared with another make operating on the relay principle which shows a total loss of only 41 watts.

The speed at which the chart should travel must be determined by the character of the load to be measured and the duration of a peak. A speed of 1½ or 2 in. per hour will suit the majority of cases and will allow a peak of five minutes duration to be scaled off the chart with accuracy.

In determining the scale capacity of a graphic meter it should be so chosen that with the average working position of the pen it will be at least half way across the chart. This tends to greater accuracy in reading and in the case of an alternating current wattmeter would allow it to operate on a load with low power-factor without overloading the current windings and still keep the pointer well up on the scale. A number of examples are given in this connection.

With reference to repairs and maintenance with which the paper deals at length, it is pointed out that a good deal of skill and patience is necessary and that the person undertaking the work should understand the instrument pretty thoroughly. It is not advisable to do extensive repairing except in the repair shop. This applies also to re-calibrating Care must also be taken in shipping and installing these instruments. Figures are given showing the cost of repairs on the different parts, and it is pointed out that the largest item is generally the labor. A number of specific cases of troubles located and their methods of correction are also given.

The cost of operation of these instruments is often considerable, for example, in the case of a direct reading instrument where 200 watts is consumed this would work out at $16.50 a year, supposing energy costs 1c per kw. hour. To this is added the cost of testing and repairs, charts, etc.

The paper deals at length with the methods of testing graphic meters both in the shop and in service. The testing equipment in the shops of the Electric Power Company are illustrated and described and the diagram of the meter testing switchboard is shown. Testing in service generally consists of comparing the readings of the graphic meter with a portable standard type and noting the error.

Discusson

A general discussion followed, in which Mr. Bird, the president, Messrs. Brown, Dion, Kay, O'Donnell, Gratton, Baker and others participated. It was generally conceded that this paper represented what might almost be classed as a hand-book on Graphic Meters and which would prove of the greatest value to operating engineers, inasmuch as the suggestions and statements contained therein were based on the practical experience of the writer. The value of the graphic meter as indicating the actual load conditions under which any company may be working, was emphasized by a number of the speakers. The opinion was expressed, however, that Mr. Gratton's point of view, with reference to the relative current consumption of the two types of meter may not be of such importance as the paper would lead one to suppose. The current consumption in either case was not material and the direct type possesses advantages which may offset the lower operating cost of the relay type. The opinion was expressed that manufacturers should be encouraged to furnish more information regarding the operation and repair of these instruments which were more or less of an enigma to many of the operators. The point brought out in the paper that some convenient device for short circuiting the transformers for testing purposes also met with general approval as did also the description of the system for making tests. One of the speakers, however, thought the system of removing meters for testing would cause unnecessary delay, and that service tests would in general be quite satisfactory. In answer to a question Mr. Gratton stated that they had tried out the printing attachment on their meters and found that it introduced a certain inaccuracy, probably in the enighborhood of from 8 to 12 per cent.

INTEGRATING WATT METERS WITH RECORDING ATTACHMENTS

By S. S. Baker

Mr. Baker classes electric meters for registering peak loads under three headings: integrating meters operating pens which give a continuous record on a paper chart of the momentary values of the power at every instant of time; integrating demand meters which sum up the kilowatt hours over given intervals of time and register the kilowatt hours consumed in each interval; and heavily-damped indicating meters for registering peak loads, whose indications approach the true present value of the power at a rate which is proportional to the difference between the present indication and the present true value of the meter.

A description of a new type of integrating demand meter occupies the greater part of Mr. Baker's paper. In this new meter a Westinghouse watt-hour measuring element is used and the clutch device which operates the recording mechanism is upon a shaft, which rotates once for every hundred revolutions of the meter shaft. The total retarding force of the clutch mechanism amounts to about 2 per cent. of the full load torque of the meter and by compensating for this quite accurate results are obtained under running conditions where the peak load registered is 10 per cent. or more of the full scale deflection of the meter.

On the clutch shaft an electrically released clutch is mounted which remains closed for an interval of one minute. A contact operated by a clock then closes and releases the clutch for a length of time sufficient for the clutch to disengage and be pulled back to the zero position by a spring. The opening of the clock contact again allows the clutch to close and be driven for another minute by the watt-hour element. An arm mounted upon the driven half of this clutch engages a pen mechanism so arranged that the linear deflection of the pen in a direction at right angles to the travel of the paper is proportional to the number of revolutions of the clutch. The deflection of the pen at the expiration of the time element selected for the measurement of the demand therefore measures the kilowatt hours consumed, or, in other words, the "integrated demand" during that interval.

The following advantages are claimed for this meter over ordinary types of the graphic instrument:

(1) Reduced interruptions to meter chart, due to clock and pen trouble.

(2) Increased permanency of calibration.

(3) Increased accuracy in reading of peaks, on account of peaks on chart being perfectly definite.

(4) Reduced maintenance expense.

(5) Determining of peaks on a kw.h. basis.

Discussion

The chief objection raised to this meter appeared to be that inasmuch as most contracts are based on longer peak durations than one minute, theinformation gained by this type of instrument would not possess any particular value for the central station. It was explained, however, by the author, that the cost of such an instrument would not be appreciably greater than the ordinary wattmeter and that the information given would often be of the greatest value to

central stations in that they would have records of their actual operating conditions. The fact was also brought out that many contracts are now based on the average of a number of peaks in which case this type of meter would be particularly useful. The author also explained that though the meter onexhibition indicated only a minute peak, types were also in course of manufacture which would record five minutes or greater if necessary. It was even possible to have attachments so that a meter may be changed from one peak duration to another without any great loss of time. The general opinion seemed to be that the more accurate information given by this new meter would be of great value to the central stations. After the discussion was over the meter was the centre of a group of interested enquirers, to whom Mr. Baker more fully explained the instrument and its usefulness.

ORGANIZATION OF AN APPLIANCE DEPARTMENT

By B. E. Rowley

The paper emphasizes the necessity of fostering a spirit of friendliness and confidence on the part of the customer. Emphasize your attitude by instructing all employees to make a careful note of complaints and see that the proper department follows and adjusts them. Much irritation is caused by hurried answers to complaints either personal or over the telephone, and much can be accomplished if an earnest attempt is made to convince the customer of the friendly attitude of the company and their intention to be square and reasonable in their dealings.

Demonstrations are valuable to illustrate the uses of the various electrical appliances. If you have in your employ a man who can deliver a short address on lighting or other applications of electricity to residences, this can be made supplementary to evening demonstrations. As many prospective customers as possible should be induced to attend these evenings and the talks should not be over their heads. It is not well to cover too much ground in one evening; deal thoroughly with one appliance and speak in a suggestive way of others so as to arouse the curiosity of the listeners.

With reference to the terms of sale the paper takes it for granted that payments will be on the instalment plan. There need be no apprehension about the life of the elements of reputable equipment as these can now be depended upon to outlive their guaranteed age.

Men should be employed in the sales department who show a natural aptitude for that kind of work. Personal appearance, good mental training, youthfulness, etc., are all valuable in this work. Good men often object to canvassing, but this distaste can generally be overcome if the matter is approached in the right way. If the relations between the company and the customer are friendly any employee of the company will generally be welcomed. This is especially so if letters have been sent out previously, announcing that at some early date a representative of the company will call to further explain any matters in which the customer may be interested. It is deemed inadvisable to send a man out with more than one appliance at a time, but he may have photographs and prices of other things with which to arouse the interest of his solicitors. This type of work can be made more attractive to good men in that the company can afford to pay a larger salary. Big money is often made by salesmen working on commission.

It is necessary that salesmen should frequently be called together for an exchange of ideas and experiences. If your salesmen show a tendency to grow stale and to think that there is no more to be learned in the selling business, have a lecturer from some other organization come and give them a short talk and they will soon see that there are still little kinks in the business that they did not know anything about.

Under some circumstances women are the best media of placing appliances before the customers. These can often gain access through telephone appointments where men would have more difficulty.

Special attention is drawn to the value of an attractive office, display of electrical appliances. Make this as artistic in appearance as possible and keep everything on it and above it looking fresh and bright. This table will be all the more valuable as many visitors are more likely to purchase when they can pick up an article and examine it without being bothered by a salesman.

A number of forms for use in the appliance sales department are appended.

Discussion

This paper was discussed by Messrs. Pratt, Dion, Magalhaes and others. The question of commission on wattage sales was raised, and it was stated by one of the delegates that it was their custom to pay their solicitors so much per unit. Payment according to wattage sales was scarcely a fair basis in that some appliances which may consume less current were quite as valuable from the central station point of view as others that may consume more current, as for example, if a certain appliance meant the introduction of electricity into a home for the first time. The speakers were unanimous in approving the lessons of energy and initiative in the sale of appliances taught by this paper. It is necessary that we be more aggressive, more systematic and more co-operative to get the best results in commercial sales. This co-operation is necessary between the different branches of the business, including the advertising, the display in the window or on the counter, the salesman, etc. It is well to feature advertising throughout all these departments, all working together on one particular piece of equipment at the same time. In one company it is the custom to have a number of bill boards located at different points of the company's offices, on which is pasted the advertisement appearing in the press for that day. By this means all the departments are given a chance to wor kin unison along the line of this particular advertisement.

THE HYDRO-ELECTRIC RULES AND REGULATIONS AND THE NATIONAL ELECTRIC CODE

By H. F. Strickland

This is a description of the most important points in connection with the new set of wiring rules recently printed and distributed by the Hydro-electric Power Commission of Ontario, and which are to regulate all wiring installations in Ontario. Mr. Strickland pointed out the similarities and differences between the Ontario regulations and the National Code, showing that many repetitions in the National Code had been avoided as well as the many cross references to be found there. However, it is pointed out that the general rules as now printed in the National Code remain practically unaltered so that the manufacturers and dealers in electrical supplies will not be adversely affected.

The writer points out that nowhere on this continent is there a state inspection similar to that now proposed, although there are numerous civic inspection systems, both in the United States and Canada. These however, are isolated from one another, and even in the interpretation of the same set of rules there is a very great difference observable. This diversity of interpretation of the rules makes it very difficult where contractors are called upon to execute work in different cities.

Under the Power Commission Act every municipality in the province of Ontario must provide a sufficient and proper number of inspectors to enforce the rules adopted, and, owing to the fact that all disputes as to interpretation must be referred to the commission for final adjustment, there will be such uniformity as will be not only of advantage to the

general public, but will also be a great source of satisfaction to all those engaged in the electrical business.

The Hydro rules and regulations have not been drafted with the idea of covering every conceivable form of construction, but with the purpose in view of covering all general inside wiring, such as is met with in every day practice and which any one is liable to be called upon to perform. Prominent among the new rules not found in the National Code are also those necessary for the protection of life. Rules have been introduced in this connection calculated to protect unskilled persons who are liable to inadvertently come in contact with live wires. The paper points out that while it is, of course, impossible to make such installations absolutely fool-proof without placing such restrictions around them as to make their general use impracticable, every effort has been made to so reduce the danger that the use of electricity will, to all intents and purposes, be safe.

The paper cites a number of instances of defective wiring which have come under the personal notice of Mr. Strickland, and which, to the professional man, seem absurd in their glaring carelessness. It is hoped that the new rules under a proper system of inspection and regulation will, in the shortest possible time, remove all these sources of danger.

Discussion

Mr. Strickland's paper came in for considerable criticism, due chiefly to the fact that by the act which gives the Ontario Hydro-electric Power Commission power to create and enforce a set of rules, the same body is made the judge of its own work and at the same time is the final arbiter in any matters of dispute which may arise between a municipality and a private company. Whether this scheme will work out or not in practice remains to be seen. A number of objections and apparent contradictions in the working of the rules were called to the attention of the convention by Mr. Hood, who read a carefully prepared criticism of the situation. Mr. Strickland's reply was to the effect that these rules were tentative in their application, and that as or if they were found unequal to the requirements of the situation they would be changed or amended. It was also pointed out by the author of the paper that this was not intended to be a text book or treatise on the method of making electrical installations, and that little details would have to be worked out in individual cases by getting the inspectors together or by taking up the point at issue by conferences between the inspectors and the municipalities. While the hydro commission would be supreme their power would be used only to see that the inspectors carried out the rules with reasonableness and justice. There was an undeniable general feeling, however, among the convention members, that the inspection department having charge of this work should be a separate organization from the Hydro-electric Power Commission, and if workable, should not even be responsible indirectly to the commission, but rather perhaps to the commission's engineers, or even directly to the government.

UNDERGROUND DISTRIBUTION FOR SMALL CITIES

By S. Bingham Hood

At last year's convention Mr. Hood read a very interesting paper on some of the best types of overhead construction. His paper this year dealt in the same interesting and authoritative way with underground work for smaller cities.

The paper points out that the ordinary conduit system of underground distribution is generally considered too expensive for smaller cities and towns. This is shown by a table of cost data, which states for example, that for an eight duct line, which would be required in a large city system, the duct system represents about 23 per cent. of the total cost, whereas if a four duct line is installed, which is about such as would suit a small city or large town, this figure becomes 70 per cent.

Mr. Hood advocates laying the cable solid in the earth. Cables laid in this way are not subject to any deterioration other than mechanical injury. However, the three core armored cable which is considered good practice on the European continent is not approved by the writer for the following reasons: (1) the jute protection between the armor and the lead sheath will depreciate sooner or later, and leave two dissimilar metals in close proximity, with the inevitable result; (2) in the event of the earthing of the neutral and one outer, the armored sheath will cause an inductive drop which will prevent the other outer being continued in service. The writer advocates the use of a solidly earthed neutral of bare copper in the form of a bond wire around the various earthing points.

This requires only two insulated and lead sheathed single conductor cables for a three-wire system. The combined cost of these and the bare neutral will not exceed the cost of a three-core armored cable and they possess all the advantages of two independent, two-wire systems as to reliability and continuity of service. The method of installation advocated in the paper is to separate each conductor at least 4 in. from the bare neutral, after which the group of cables is covered with from 4 in. to 6 in. of earth and then a cover board of rough lumber laid in for protection.

The paper discusses the different causes resulting in mechanical injury to cables and shows that the kind of installation advocated is not liable to serious or frequent injuries, and quotes an instance where a similar installation has been in operation for over two years under very adverse conditions without causing any trouble whatever.

The latter part of the paper is given up to wiring diagrams, and their explanation, showing various methods of secondary distribution for light and power.

Discussion

The reduced capital expenditure possible by the use of the system outlined by Mr. Hood created a great deal of interest among the delegates and valuable contributions to the discussion were made by Messrs. Angus, Dion, Croucher, Hood, Harris, Marsh, Mudge, Pratt, Hicks and others. Mr. Dion spoke of the situation in Ottawa where it had at first been decided to use the draw-in system, but after mature consideration they had delayed the matter, feeling that the solid system had not been given sufficient thought and that with proper cables, properly laid, this type of underground would probably suit their requirements and at much less expense. The discussion rather tended to disprove Mr. Hood's contention that steel armored cable was apt to give trouble on account of the jute lining between the two metals deteriorating and setting up electrolytic action. This theory did not appear to be borne out by the experience of any of the delegates. Regarding the question of grounding the sheath it was shown to be the pretty general practice to ground everything—the gas pipes, water pipes, sewers, street railway returns, etc. The least trouble resulted when everything was solidly grounded together. It was pointed out by Mr. Mudge that the steel armored cable appeared to be the most satisfactory for 3-phase distribution, but on single-phase, as described by Mr. Hood, there was little doubt that the lead covered type would prove quite satisfactory. In answer to Mr. Pratt's question as to whether this solid system of underground work was flexible enough for growing towns, Mr. Hood replied that it was not. It was only in towns or small cities, on streets that had developed practically to their limit or where the maximum development could be foreseen that this type of distribution could be used with ultimate satisfactory results. This system, Mr. Hood stated,

was quite satisfactory for series distribution, as for example, in the operation of magnetite arcs.

MAGNETITE STREET LIGHTING

By Mr. L. Burpee

This paper first deals briefly with the history of the development of the magnetite arc lamp. The life of the open arc carbon was about sixteen hours. The next step was the enclosed arc with a life of between 100 and 150 hours per trim. The metal electrodes have a still longer life. The upper and positive electrode in the latest type of magnetite arc is made of pure copper; in the 6.6 amp. type the life of this electrode is from 3,000 to 4,000 hours on the average, and about 8,000 hours for the 4 ampere type. The lower and negative electrode is a sheet iron tube filled with magnetic iron, titanium oxide and chromium oxide; the life of the 6.6 amp. electrode averages 125 hours and the 4 amp. type averages 225 hours.

The paper contains distribution curves comparing the 4 ampere magnetite, the 6.6 amp. magnetite, the 6.6 amp. enclosed arc and the 9.6 amp. open arc. These curves, with corresponding figures, show that much better distribution is obtained from the magnetite lamp. The open arc gives maximum intensity of 1250 candle power at 45 deg. below the horizontal and at 15 deg. below only 600 candle power. The maximum of the 4 amp. luminous lamp is 700 c.p. at only 5 deg. below, while that of the 6.6 amp. magnetite is 1625 c.p. at 10 deg. below. The efficiency of the open arc lamps in watts per hemispherical c.p. is exactly equal to that of the 4 amp. magnetite lamp, but the latter gives the same intensity of illumination at 327 feet that the open arc gives at 198 feet, showing the superiority of the magnetite lamp as a street illuminant. The 6.6 amp. magnetite lamp with an energy consumption only slightly greater than that of the open arc gives the same illumination at 510 feet that the open arc lamp gives at 198, which is equivalent to a range of 2.58 times that of the open arc lamp or an area 6.65 times as great. The construction of the magnetite arc lamp is described in detail and its application to ornamental street lighting explained. Comparisons are also made of the light distribution as compared with tungsten clusters consuming the same amount of energy, and it is shown that the ratio between the light given by the arc and the tungsten cluster at different distances works out as follows in favor of the arc lamp:—at 10 ft. 1.95; at 20 ft. 2.5; at 40 ft. 2.7; at 60 ft. 3; at 80 ft. 3.1; at 100 ft. 3.2. The data all goes to shown in a remarkable degree the efficiency of the magnetite lamp as a street illuminant.

The author deals at considerable length with the mercury arc rectifier and states that experience has proven that these now operate under full load with an efficiency of over 99 per cent. and with a life that has reached 16,000 hours.

FLAME CARBON ARC LAMPS

By T. J. Pace

This is a description of the long burning flame carbon lamp recently placed on the market to take the place of the short burning flame lamp, which, on account of its short carbon life was not suitable for street lighting and similar requirements. The new lamp will give an electrode life of from 100 to 125 hours per trim without serious depreciation in light intensity.

By the use of suitable carbons a light of almost any commercial color may be obtained. For street lighting purposes, carbons giving a white light are most generally used, colored lights being confined to display or industrial plant illumination. The yellow light carbons give a considerably higher illumination than the white light carbons.

The efficiency of the new flame lamp is particularly high, being anywhere between 2.5 mean low hemispherical candles per watt with white carbons and alba glassware and 5 candle power per watt with clear glassware. The lamp requires 10 amp., operates with an efficiency of 88 per cent. and a power-factor of 81 per cent.

With the exception of the enclosed carbon lamp this long burning type covers a wider range of application than any of its predecessors. It will operate on series and multiple alternating current and direct current circuits and in multiple series on direct current power circuits. Also by the use of a self-contained or external auto-transformer, individual a.c. constant current lamps may be placed on an existing circuit of a different current value. This scheme is frequently resorted to when it is desired to increase the illumination at certain points, as for example, at prominent street corners.

This lamp also operates on frequencies as low as 25 cycles, though there is a slight decrease of light at each reversal due to the cooling of the arc gases. This is not considered objectionable under most conditions.

The paper gives some camparative figures of the carbon and trimming costs of the old short burning flame carbon and the new long burning flame lamp, placing the yearly expense of the former at $56.60, and of the latter at $7.78. It is also pointed out that there is an additional saving of time due to less frequent suspension of work in order to retrim the lamps.

Figures are also given, showing the relative operating costs per year of 4,000 hours, of four different types of lamps in use to-day for street lighting purposes. The a.c. series enclosed carbon type consuming 6.6 amps., costs $25.42, to operate; the new flame carbon series lamp consuming 10 amp., costs $35.23; the metallic flame lamp using 4 amperes, costs $24.49, and the metallic flame lamp using 6.6 amp., costs $36.55. A number of illustrations of the lamp are also given.

Discussions

The papers on the luminous arc lamp and the new flame carbon arc lamp were both illustrated by lantern slides comparing in a number of cases the illumination of certain streets during the day and at night time, to the apparent advantage of the night illumination. The discussion showed that a number of the delegates had had favorable experience with these two types of lamp. As an example of comparison between the five-light oranmental tungsten cluster and the magnetite arc, for example, the case of Calgary was quoted where two adjacent streets, located in such a position that they may be observed from the same point, are said to show up the magnetites to particularly good advantage. Another speaker drew attention to a Buffalo installation, where, under similar circumstances, the arc also gives the more favorable results. Most of the speakers dwelt on the value of the illumination of the buildings, stating that in many cases they knew of, all the details of the architectural design were more clearly brought out at night than even during broad daylight. In this connection it was intimated that the growing use of electric signs might, in this way, be rendered unnecessary. The statement was made that even at the present time installations of ornamental clusters are being replaced by arc lamps, as being more efficient in operation, and as giving a better distribution; this is especially the case where there are no trees to block the light rays so that the source of illumination may be placed 16 or 18 feet above the sidewalk. The inherent difference between the two types of lamp described in these two papers is that the magnetite will only operate on direct current while the carbon will operate on either alternating and direct, and on a cycle as low as 25. In answer to a question by Mr. Hastings, Mr. Burpee stated that the rectified 25 cycle current did not show any tendency to flicker.

ELECTRICITY ON THE FARM

By Jno. C. Parker

The paper draws attention to the value of the farm load as a means of extending the off-peak demands on the central station. The company with which Mr. Parker is associated are making a thorough investigation of the requirements of the case and have one man detailed to do nothing else but study the possibilities of farm electrical applications.

The cost of the installation has been one of the most difficult features. Farmers are loath to spend much money on equipment which they operate only a few minutes every day, and the writer is of the opinion that it would be better to install less expensive equipment even at the cost of higher current charges. He bears out this opinion by figures which go to show that current costs represent only a small percentage of the total cost of operation, in some cases as low as 6 or 7 per cent. On this basis it is evident that if the cost of reliable equipment can be lowered considerably the actual expense of the energy will not be a serious obstacle in the way of extending the application of electricity much more generally to farms.

Mr. Parker also objects very strongly to the type of literature often distributed in this connection, showing for example, a woman in a conventional evening dress gazing pensively at a luminous radiator, or the house-wife reading a novel while the washing machine is being electrically driven, etc. He recognizes that the average farmer does not approve of these tactics and certainly will not spend very much money to create such a condition. The literature must be made much more real and sane. Such advertising as the above tends to create the impression that farms must be electrified for sentimental rather than industrial reasons, which is entirely wrong.

The paper gets at the kernel of the situation in stating that the value of electricity on the farm is in its solution of the labor problem. It is not that the electric motor will develop more energy at $1.50 per day than will the average farm laborer, but that the electric motor can be induced to stay on the farm and be ready for work when it is wanted, which the farm laborer cannot. Year by year the matter of securing even indifferent, unintelligent and unskilled farm help becomes harder and harder. The electric motor is not merely a device for supplanting man power, but for freeing the farmer from his dependence on the man at all. In other words, electricity on the farm will be—when it comes to its own—a solution of one of the social problems in farm economics.

The paper suggests a new application of the use of electricity on the farm in the pruning of orchards. This is to be done in the same method as trees are now sometimes felled by electricity. Not only would this do the work neatly and quickly, but it would close the wound at the same time.

The writer places the blame for the slow advance in the use of electricity on the farm on the central station men who have not been sufficiently aggressive in following up this kind of load. The farm business is going to be worth cultivating. The farmers are going to use more energy than at present seems possible. In the meantime it will help if the costs of the wiring installations and the electrical equipments are kept down to the lowest possible figure.

Discussion

Mr. Parker interpolated the different points in his paper with a number of interesting explanatory side talks, emphasizing even more strongly than his paper had originally done, the value of the farmer as a customer for the central station and the possibilities in the way of the central station making itself useful to the farmer. The point was emphasized that the central station must come to have the farmers' point of view as well as his own so that he may be able to supply the needs of the case in the quickest and most economical way. Mr. Parker believed that at the present time the necessary activities of the farmer covered too wide a field, ranging from that of a specialist on the one hand to the work of a mere laborer on the other. He believed that by the introduction of electricity the manual part of the requirements might be taken off his hands which would leave the farmer more time and energy to devote to the scientific development of his chosen pursuit. The speaker believed there is a great field ahead in the way of intensive farming when the value of the crop yield will be greatly increased by scientific treatment copuled with careful and business-like methods of gathering and disposing of the crops.

Interesting remarks were made by Mr. Peeling and Mr. McLellan, of the Electric Power Company. Mr. McLellan is the one man in this company who has come more closely in touch with the farmer than probably anyone else in Canada, and he was able to outline in a very practical way the difficulties met with and the results likely to be obtained from a further pursuit of this kind of business. M. McLellan also was equally hopeful that in the very near future when the farmer can be brought to understand the advantages of the use of electricity and whe nthe cost of the initial installation can be reduced somewhat and made sufficiently rugged that it requires practically no technical attention, the business of farm supply can be very greatly increased. A detailed account of what the Electric Power Company is actually doing in the Trent Valley Canal appeared in the June 1 issue of the Electrical News.

THE ELECTRIC VEHICLE

By Stephen G. Thompson

Although there is ample field for the use of the electric pleasure vehicle the probability of its general adoption appears remote at the present time on account of the relatively high first, cost as compared with the gasoline machine. With the electric power wagon, however, the case is entirely different owing to the utility features of this vehicle. On every hand electric vehicle installations are now to be found where the investment values are of such magnitude as to indicate that the selection of this type could only have been made after exhaustive investigations. The very fact that electric vehicles have not been peddled and that they have practically sold themselves on their own merits, is the strongest argument in favor of their becoming very generally used in the near future.

This paper points out that the requirements of a city service are not so efficiently filled by a gasoline machine as by the electric. Frequent starts and stops reduce the speed of the gasoline below that of the electric and it is a fact borne out by figures given in the paper, that the actual speed of the electric machine is greater, through the crowded streets, than that of a gasoline truck. These figures go to show that in one test covering a triangular course the electric vehicle made the distance at an average speed of 9.65 miles per hour as compared with 8.48 miles per hour for the gas machine, and in test No. 2, also over a triangular course the electric's time averaged 10.03 miles per hour as against 9.48 for gasoline. This was in spite of the fact that the electric vehicle was geared to a maximum speed of only twelve miles per hour while the gasoline was geared up to eighteen miles.

Another point brought out in the paper is the relatively lower cost of maintenance of the electric. Figures are given which show that the average cost per car mile for maintenance of the electric truck increased only 13 1-3 per cent. in tests covering 69 machines over a period of four years. The cost of maintenance of the gasoline increased 362½ per cent. in 54 machines over the same time. The figures show that the average maintenance cost per car mile for the electric machine after seven months operation was 7.5c and after 48

months operation was 8.5c. The figures for the gas car under the same conditions were respectively 4c and 18c.

ELECTRIC VEHICLES FROM THE CENTRAL STATION POINT OF VIEW

By C. Rummel

This paper describes the electric vehicle situation in Vancouver particularly, and to some extent at other points in British Columbia. The B. C. E. R. Company had been forced into handling electric trucks because locally these were being sold by agents who were equally interested in gas cars and who naturally followed the line of least resistance. In the interests of the industry therefore, the company had deemed it best to, itself take charge of the supply of electric trucks in Vancouver and neighborhood.

At the very outset the company engaged an electric vehicle expert with ripe experience, both in selling and garaging. The industry was advertised extensively in the daily press, pointing out the advantages of electric trucks. This was followed up by an active personal canvas, follow-up letters, etc. One very effective method of advertising used was to offer the service of one of the company's trucks to reliable "prospects" for an ordinary day's delivery of the firm; such an illustration would give the merchant the best proof of the value of the truck in his particular line of business.

The paper outlines the various types of truck and the number at present in operation in and around Vancouver. The prospects are reported as very numerous, and already there are a large number of satisfied customers.

As a necessary supplement to the use of the electric vehicle, this company had found it advisable to establish an electric garage with a charging outfit of 45 kw. capacity, and a schedule of rates has been established as follows: for a 750 lb. capacity, $45 per month; 1000 lbs. capacity, $45 per month; 2,000 lbs. capacity, $55 per month; 4,000 lbs. capacity, $60 per month; 7,000 lbs. capacity, $65 per month; 10,000 lbs. capacity, $70. These charges cover the current supply, storage of the vehicle, washing and oiling and the making of minor adjustments.

The paper reports that in both Vancouver and Victoria a number of private garages are equipped with charging outfits, and the company also plans to maintain charging equipment at different central points within its territory.

Mr. Rummel concludes by pointing out the great advantage of the electric vehicle load to the central station man. He also raises the question of the almost prohibitive price of the electric truck. There is no question about the economical operation of the electric truck when the rates that can now be offered by the central station are taken into consideration, and the next move should therefore be on the part of the manufacturers, to produce a vehicle at a more reasonable cost.

Discussions

The two papers dealing with electric vehicles provoked a lengthy and valuable discussion to which contributions were made by Messrs. McBurney, Dion, Keyes, Lambe, Merritt, Oborne, Hillman, Maclachlan, LaChapelle, Magalhaes, President Bird and others. The opinion was expressed that the cost of electric vehicles as given in Mr. Rummel's paper was higher than the figures obtaining in many cities in Canada. Above, say, the two-ton capacity truck, the cost of the electric vehicle was not appreciably different from that of the gas truck. The probable reason that below this capacity the figures showed a greater discrepancy could be accounted for by the fact that the low capacity gasoline so-called trucks were not in reality trucks at all, but were for the most part truck bodies laid on a passenger chassis, whereas electric trucks of this capacity were built on the truck principle. Actual figures brought forward by a number of the speakers showed that the discrepancy in costs was far from being as large as is generally supposed. Taking into consideration the longer life of the electric and its lower operating costs, it can even now be shown that the electric is well to the fore in the competition between the two kinds of trucks. Certainly with a reduced initial cost which must come with more general use, it will be no uneven competition in the very near future.

In respect to cost of operation a number of very valuable facts were brought out. Mr. Dion suggested that where it was mentioned that the increase in operating costs per car mile was from 4c to 18c for a gas car it must also be taken into consideration that this would inevitably be accompanied by many interruptions in the service. On the other hand the fact that the electric operating costs only increased by a few per cent. indicated a continuity of service that was highly satisfactory. Some examples of actual operating costs were given by a number of the members present. One stated that the current costs for their one truck amounted to 1.8c per mile for current with a total of 6c per mile operating expenses, this being taken the year round as the car was operating throughout severe winter conditions. As another example of the splendid showing made by electrics the cost of operating two 3½ ton trucks and two 5-ton trucks by a brewing company was stated to be about $30 for all per month, for current; whereas the gasoline alone for each of these trucks would cost in the neighborhood of the same amount per month. This operating cost worked out at about 1c per mile for current alone.

Of the equipment for charging, motor generators were considered the most satisfactory. With the conditions under which private garages operate mercury rectifiers these were not found to work out as satisfactorily, largely on account of lack in the necessary attention required by this equipment.

Some startling figures were given as to the revenue derivable from this kind of load. It was stated by one of the speakers that while they do not make any special rate for this kind of load they find that the income per kilowatt of demand works out to something like five times as much as that resulting from any other kind of commercial load, including motors, household equipment, etc., etc., obtainable by the average central station. When it is considered that the central station has almost absolute control of this load charging the batteries at a time when his energy cannot be used for any other purpose, this must be considered as a clear gain. Many companies in the United States and in Canada are at present in receipt of many thousands of dollars annually, therefore, practically without the expenditure of any additional capital.

The attitude of the speakers was rather an opposition to the idea of the central station constituting itself a sales agent for the exploitation of electric vehicles. It was considered the best policy to leave this in the hands of the ordinary agents and co-operate with these in every possible way. A number of the companies do operate a public garage where they charge batteries for trucks and pleasure vehicles and in a few cases attend to repairs, but only in so far as it is found necessary to do this in order to encourage the industry, and increase the station load, would it be a justifiable proceeding.

Storage batteries are evidently standing up well under the conditions as encountered in the various cities in Canada. In Montreal where it was intimated that the roads are about as bad as are usually found, the results were quite satisfactory. Some forms of battery would stand low temperatures better than others, but if the necessary precautions were taken to protect the battery from cold, it was found that these would operate through the winter under con-

ditions in which gas cars had proved a failure. No instance was related by any of the speakers where it had been necessary to set aside their cars during our severe winter weather either because the batteries were unsuitable or because any other part of the car would not stand the severe conditions. The reports in this connection were surprisingly encouraging.

The president summed up the discussion by saying that it was evident no central station could make any mistake in following up the matter of electric vehicle exploitation as vigorously as possible.

SERVICE

By Stephen L. Coles

This paper emphasizes the self-evident proposition that, where the public is being served, it is necessary to keep prominently in mind that that service should be the best possible. This is especially true in the central station business where they come more intimately in touch with the consumer than is the case in any other line of business, in that they supply light, heat and power to the home, the store, the office, the hospital, the theatre, the factory, and frequently for transportation. The most valuable asset a central station can possess is the good will of the public it serves. Nothing that enters into service or has any bearing upon it should be considered trivial. That central station manager more nearly approaches the ideal of service, who keeps his eye on the little details of his business. The paper finally draws attention to the fact that every point of contact between the company and a customer is an opportunity for service. The manner in which any such opportunity is grasped is an exact demonstration of the company's ability to give service.

Discussion

The keynote of the discussion which followed the reading of this paper was the outstanding value of a prompt and courteous service. It had until recently, been considered that a low rate was the most important consideration in going after a prospective customer's business, but it had been shown that this was now a matter of secondary consideration and in certain cases where competition was keen, as for example, between a municipality and a private company, the latter were often able to demand a higher price for their current owing to the fact that they gave a better service. Considering that the cost of current is a comparatively small percentage of the total cost of operating any manufacturing concern this point of view could easily be made to carry weight with the consumer.

A number of the companies maintain an emergency department night and day in connection with which skilled operators are available at a few minutes notice. As a general thing it is not the custom to make extensive repairs, this being considered the province of the electrical contractor, but where the customer is going to be inconvenienced by delay, it was considered good policy on the part of the company to do everything in their power to make repairs so as to relieve the customer from any unnecessary discomfort. The necessity of advertising in the daily papers was considered for the most part essential even if the company happened to be operating in a town where there was no competition. It kept the consumer in touch with the source of supply and got him into the way of feeling that the central station was thinking about him and thinking about his interests. While it may not be, strictly speaking, the function of a supply station to maintain a department to search for troubles which occur in the installations made by electrical contractors it is often the best policy to do so partly from the fact that the electrical contractor is not available on the spur of the moment and that he rarely carries a sufficient force of operators to attend to emergency calls, while on the other hand the company's office was accessible at all times. For sentimental reasons, too, it was of value to the central station that the consumer should get into the habit of looking to them for assistance. Troubles properly attended to with the utmost speed even at a considerable expense often introduced friendly relations between the customer and the central station which resulted advantageously to the latter in the increase of their business.

CENTRAL STATION ADVERTISING

By D. H. McDougall

The various methods of advertising are divided into two classes:

(1) By direct contact with the public.

(2) By printed advertisements.

And in connection with the latter it is necessary

(1) That the advertisement must be read.

(2) The advertisement must be true.

The first division of advertising (direct contact), and the most important, is divided into

(1) Delivery of the goods.

(2) Courtesy to the public at every point of contact.

(3) Direct personal canvas.

(4) Periodical visits to consumers to solicit criticism and forestal complaints.

(5) Prompt and cheerful attention to complaints of customers by means of an efficient emergency force.

The author considers that the direct method of advertising is undoubtedly the best. Every employee of the company is a medium for advertising the company. He should be courteous and efficient, which characteristics, next to the actual delivery of goods, are the best method of advertising the company's business. This is true of every employee whether telephone operator, complaint clerk, demonstrator, billing clerk, office boy, or delivery man. Especially the complaint department is one of the most important branches of the business and the company should select with the greatest care the men who handle the complaints.

Under the heading of printed advertising the following classification is given in the order of considered importance.

(1) Direct advertising such as company magazines, circulars, letters, pamphlets, etc.

(2) Daily newspaper advertisements.

(3) Bill board, street car and electric signs.

(4) Weekly papers and magazines.

(5) Theatre programmes, etc.

Mr. McDougall considers the best of these is a properly prepared company magazine. Through this medium it is possible to supply a great amount of elementary information which attracts the reader and puts him in the way of doing business with the company. The value of newspaper advertising depends very much on the attitude of the press, as a large advertisement can easily be neutralized by a small antagonistic editorial. Of the other methods of advertising, namely, bill boards, street car and electric signs, the sign is placed first, but it is thought that these are better adapted to advertising manufacturers' articles. It is also suggested that dignity is lacking in many of the modern signs.

The paper concludes by again emphasizing the advertising value of good service which means delivering the goods in every branch of the organization with efficiency and courtesy.

POLE TYPE TRANSFORMERS

By C. T. Sisson

This paper discusses some of the more important details entering into the design and construction of the modern lighting transformer both from the operators' and manufacturers' view point. The essential features of the lighting transformer are safety, durability, economy of operation

and first cost, these being dependent largely upon the following factors: insulation, ageing, temperature rise, core loss, copper loss, regulation and magnetizing current.

Safety depends chiefly upon the insulation between the high tension and the low tension and core or ground and this should receive prime consideration.

Durability, which is dependent upon the life of the insulation, is also a matter of supreme importance. The manufacturer has perhaps not taken as much notice of this quality as of efficiency or low operating cost, but it is now a matter of consideration with most consumers what the length of life of his transformer is going to be. Durability, or what is almost the same thing, reliability, is dependent on the best arrangement of parts and the selection of the most suitable methods of insulating. The paper discusses the methods of insulation very generally used, the chief object to be kept in view being that the insulating material must be kept free from moisture and be as little affected by changes in temperature as possible.

Marked improvements in the quality of steel and the adoption of more economical designs have reduced the cost of operation greatly in the last few years. Also a decided improvement has been made in the regulation at low power-factors. Indeed the improvements would justify replacing many of the old type transformers with the later and more efficient designs.

Mr. Sisson favors the plan of having each central station test every piece of apparatus placed on the system. This is a check on the manufacturer as well as that it gives the operator a complete knowledge of the construction of the apparatus. Any difficulties resulting from handling or shipping will also be noted. The tests suggested on a transformer include insulation tests, measurement of core loss and exciting current, measurement of resistance, measurement of impedance, tests for heating and ratio and polarity tests.

The paper does not hold out any hope that the efficiency of transformers will be greatly improved with later developments. Efficiency of the better transformers now stands at from 97 to 98.5 per cent. It is predicted that the developments will rather be along the line of lengthening the age of the transformer.

CONVENTION NOTES

Three hundred delegates and guests registered.

Mr. T. C. Martin, secretary of the National Electric Light Association was an interested listener at a number of the sessions.

The Toronto Railway Company granted free transportation to all the C. E. A. delegates and visitors wearing badges. This thoughtful consideration was much appreciated by all.

The "Cabaret" on the evening of the second day of the convention attracted upwards of 300 of the beauty and chivalry of the attending delegates. The supper was good, the program, though purely amateur, a most excellent one, and the dance, as usual, a proper ending to a good day.

The theatre party on the evening of the first day of the convention attracted delegates to the number of 300. "Green Stockings" was thoroughly enjoyed by everybody, but the "hit" of the evening was the neat little speech by Miss Percy Haswell herself, in which she gave recognition to the great value of electricity in enhancing the beauty of her stage presentations.

The ladies, to the number of fifty or sixty, enjoyed a three-hour motor trip around the city on Thursday morning, viewing many points of interest and finally bringing up at the Royal Canadian Yacht Club wharf. Afterwards luncheon was served at the club's Island pavilion. The motor trip was possible through the kindness of a number of members of the association who loaned their machines for the purpose and in many cases themselves acted as guides to the party.

The Sons of Jove held a most successful rejuvenation in the Temple Building on Friday evening at which a number of prominent central station men were initiated into the mysteries of this order. It is claimed this was the most successful rejuvenation that has yet been held in Toronto, and that in point of elaborate preparation and artistic effect it has been unsurpassed by few, if any, cities on the continent.

The baseball match between the central stations and the manufacturers, while never in doubt as to the outcome, was nevertheless keenly contested. The final score of 11 to 4 in favor of the central stations, may be taken as a fair indication of the relative merits of the two teams. The score might easily have been higher had it not been that a couple of the members of the winning team have been a little slow in rounding into condition this season.

Trade Publications

Public Utilities Report—The first report of the Manitoba Public Utilities Commission covering the six months ending November 30th, 1912, is just to hand.

Pneumatic Tools—Bulletin No. 127 by the Chicago Pneumatic Tool Company, describing pneumatic drills, reamers, wood borers, flue rolling and tapping machines and grinders.

Refillable Fuses—A card issued by the A. F. Daum Company, Pittsburgh, illustrating the development of refillable fuses for electric light and power circuits. These fuses are illustrated in structure, appearance and finish.

Cleat Receptacles—A booklet issued by the Canadian General Electric Company, descriptive of Norbitt cleat receptacles and rosettes, and Crouse-Hinds temporary decorative sockets.

Indirect Lighting—A pamphlet issued by the National X-Ray Reflector Company, dealing with the origin and development of indirect lighting, including an explanation of what he calls "the semi-indirect fallacy," by Augustus D. Curtis.

Catechism on a.c. Apparatus—As a companion book to "Catechism on Direct Current Apparatus" Fairbanks-Morse & Company, of Chicago, have recently issued a catechism on alternating current apparatus. This booklet deals with the construction and application of generators, motors and auxiliary equipment, in which the writer has succeeded in giving in a condensed "question and answer" form, a very great amount of practical information. A glossary covering a large number of electrical terms used in ordinary practice is appended.

Electric Vehicles—The Westinghouse Electric & Manufacturing Company have issued leaflet No. 3679, describing electric vehicle battery switchboards and motor-generator sets. Special mention is made of the sectional switchboard, which has proven very satisfactory for this class of work, to enable additions to be made from time to time, at slight expense. Another folder, No. 4255, describes Westinghouse type PG porcelain insulators. These are insulators with high mechanical strength suitable for use on 1500 volt d.c. railway work and 2200 volt transmission lines.

Rail Bonds—The Electric Service Supplies Company have just issued their 1913 catalogue on "Protected Rail Bonds and Appliances." The catalogue is well illustrated, and besides showing every practicable type of rail bond it illustrates clearly the value of proper installation, the importance of accurate testing apparatus, and the use of bond compressors. This company report that their factory has been working night and day for several months to meet the demand for Keystone steel gear cases, and Garton-Daniels lightning arresters, in connection with which all indications point to a record-breaking year in the sales department.

The New C.P.R. Shops at Ogden

The Canadian Pacific Railway Company have recently put in operation near Calgary a large shop plant of unusual interest by reason of its size, its complete and modern character and the speed with which it was created. The work was designed and built in its entirety by Westinghouse, Church, Kerr & Company, consulting and constructing engineers, of Montreal and New York, working under the direction of Mr. J. G. Sullivan, Chief Engineer of the western lines of the C. P. R., and Mr. N. E. Brooks, Division Engineer.

The shop location is at Ogden (named in honor of Mr. I. G. Ogden, vice-president of the company), 4½ miles from Calgary. Its distance from those sections of the country where the greater part of the construction materials, machinery and equipments were obtainable, constituted one of the most important problems. A second problem arose on account of the construction season being extremely short owing to the high latitude, frost remaining in the ground until about April 1st, and returning with snow as early as October 1st. Labor is also comparatively scarce at this point, especially in the late summer months during harvesting operations. When it is pointed out that the ground was not broken until April 1, 1912, and that the locomotive shop was in full operation on March 17th, 1913, it will be appreciated that a record for prompt performance was established.

The shops consist in general of the main locomotive shop, including erecting, machine, blacksmith and boiler shops; tender and wheel shop; pattern shop and pattern storage; foundry; store house and office building; material platforms and scrap dock; oil house, coach repair and paint shop; freight car repair shop, planing mill, boiler and compressor house; 1260 ft. yard crane and miscellaneous structures, including transfer table and pit for coach shop, mess hall, driven wells, water tower and all service systems, such as drainage, sewage, fire protection, water supply, etc.

Electrical equipment has been used wherever practicable in these shops. Power is supplied by the Calgary Power Company by one 2300 volt, 3-phase, 60 cycle, 2000 kw. feeder for normal service and one 2300 volt, 3-phase, 60 cycle, 1000 kw. feeder for breakdown service. This power is transformed and distributed from two sub-stations, one of which is located in the boiler house and the other adjacent to and immediately outside of the low machine bay in the locomotive shop. The equipment of the sub-station near the locomotive shop consists of three 75-kw., 2300/230/150 volt lighting transformers; three 200 kw., 2300/600 volt power transformers; and two 300-h.p., 2300 volt, 60 cycle, 3-phase motor generator sets for the 250 volt d.c. power and a twelve panel switchboard. The high tension bus series and potential transformers and auto-transformers for motor generator sets are mounted on the wall at rear of switchboard. The electrolytic lightning arresters are mounted on a special gallery in the corner of the sub-station.

This board distributes 250 volt d.c. current for all crane and hoist service and variable speed motors driving individual machine tools; 600 volts, 3-phase, 60 cycle current for constant speed motors for line shafting and individual drive machines, and 230/115 volt three-wire single phase current for lighting, for the locomotive shop, tender shop, foundry, storehouse, pattern shop, oil house and adjacent small buildings.

The equipment of the sub-station in the boiler house consists of two 37½ kw. 2300/230/115 volt lighting transformers, three 100 kw. 2300/600 volt power transformers and an eight-panel switchboard. This board distributes 230/115 volt, single phase, three wire lighting current and 600 volt, 3-phase, 60 cycle power current for the boiler house, planing mill, freight car shop, coach shop and adjacent small buildings; also 600 volt, 3-phase, 60 cycle current for general yard lighting. This board also controls the two 325 h.p., 2300 volt, 3-phase, 60 cycle induction motors operating the air compressors which are located in the sub-station. These compressors supply all air required for shop service and pneumatic tools.

The main feeders from the sub-station supplying the locomotive shop are carried across the centre of the shop in an underground duct system. Feeder panels are located at each bay, and control overhead feeders running the entire length of the shop which supply the different distributing panels. These distributing panels furnish all current necessary for shop operation and, where possible, the circuits to machines are carried in conduit beneath the floor, thereby minimizing the amount of exposed wire in the shops. In the other shop buildings all feeders are run overhead.

The entire area of the erecting shop is served by two travelling cranes carried on two levels, (a) a 120-ton crane furnished with two sixty-ton trolleys is carried on the upper level and is used for transferring, wheeling and unwheeling locomotives and handling parts; one of the trolleys in this crane is equipped with a 10-ton auxiliary hoist for handling light material at a high hoisting speed and (b) a 10-ton travelling electric crane operates at high speed and serves the entire area of the erecting shop for handling material and transferring same to the blacksmith and machine shops.

The machine shop is supplied with a high speed 10-ton crane which covers the entire area of this shop, 778 ft. x



C.P.R. locomotive shop sub-station, Ogden.

60 ft. in size. Material is brought to the door of this shop by a travelling electric yard crane.

The boiler shop is provided with a 40-ton travelling electric crane equipped with two 20-ton trolleys serving the entire area of the boiler shop for handling the boilers and other material. A 25-ton electrically-operated crane for serving the hydraulic rivetter is erected in a special tower in the bay between the boiler and blacksmith shop. In one of the bays of the boiler shop space is provided for a flue shop and the boiler shop tools. The entire length of this space is served by a 3-ton overhead travelling trolley.

The general illumination consists of Cooper-Hewitt lamps with circuit and plug boxes for extension lamp cords. Provision has also been made for incandescent lighting circuits for individual lighting at machine tools where required, and for outlet boxes for connecting extension lamp cords to provide lighting for the interior of the locomotive boilers on the erecting floor.

The tender and wheel shop is spanned over its entire area by a 20-ton high speed travelling electric crane equipped with two 10-ton trolleys. An electrically-operated car puller is installed for hauling the equipment into and out of the

shop. The lighting is similar to that described above for the main locomotive shop.

The foundry building is served over its entire length by a 10-ton high speed travelling electric crane. An electric elevator is provided for handling material when changing cupels. For general illumination flaming arc lamps are used in the high bay and open arcs in the low bay with outlet boxes for extension lamp cords. This building is located along side and parallel with the travelling electric yard crane, which facilitates the handling of castings from foundry to storage, to the locomotive shop, or for shipment.

The storehouse and office building contains an electric elevator, Carbon and tungsten lamps are used for lighting. The storehouse is located parallel with the main locomotive shop and the space between these two buildings is spanned by a high speed 10-ton travelling electric crane which can be utilized to handle all heavy material to and from the cars. This crane is provided with a 43-in. lifting magnet to facilitate the handling of material.

A 150-ton electrically-operated transfer table is provided for serving the coach repair shop. Tungsten and carbon lamps are used for illumination of the coach repair and paint shop, oil house and pattern shop, and also for mess house and miscellaneous small buildings in the yard. Flaming arcs are used for general yard illumination. Mercury vapor lamps are used for lighting in the planing mill, and the boiler house is lighted with arc and incandescent lamps.

The boiler house contains 2100 h.p. water tube boilers divided into three batteries of two units of 350 h.p. each. Five of the boilers are equipped with chain grate stokers. The sixth boiler has shaking grates to burn shavings and other planing mill refuse. A motor-driven pivot steel elevator raises the coal and discharges it into the overhead bunkers. A skip bucket with electric hoist handles the ashes into the ash bin. Space is provided for three electrically-driven air compressors with a capacity of 1500 cubic feet per minute, two of which are installed at present.

All buildings are heated to a temperature of 60 deg. with an outside temperature of 30 deg. below zero. This is accomplished in the larger buildings by the indirect blower system, underground ducts of concrete and tile being used to distribute the air in most cases. All blowers are direct connected to horizontal throttling engines, the engine exhaust being carried to the indirect heaters. Seventy-seven thousand five hundred square feet of cast iron indirect heating surface was installed for this work. In some of the small buildings where ventilation was not a prime requisite, direct radiation was used for heating. All buildings are equipped with air, water and steam lines where such service is necessary. A complete system for fire protection has been installed in the buildings and yard, and two 8-in. wells have been driven and equipped with electrically-operated pumps for supplying the necessary water for all shop purposes.

Robb Boiler Contracts

Robb water tube boilers are being built at the International Engineering Works Limited, Amherst, N.S., for the Pictou County Electric Company, Stellarton, N.S.; Ottawa Gas Company, Ottawa, Ont.; and the Inverness Railway & Coal Company, Inverness, N.S. The International Engineering Works have recently sold horizontal return tubular boilers to the following companies: St. Lawrence Pulp & Lumber Company, Pabos Mills, P.Q.; N. S. Clay Works, Halifax, N.S.; Maritime Coal, Railway & Power Company, Joggins, N.S.; Record Foundry & Machine Company, Moncton, N.B., and the Rocky Mountain Cement Company, Blairmore, Alta.

Oil Switches

By W. A. Coates, A.M.I.E.E.

In a recent article on the protection of electrical circuits, attention was drawn to the necessity for employing switches of ample capacity to handle not only the known normal load of the circuit, but also the possible emergency load due to heavy "shorts" on the distribution side of the switch. The present article is intended to deal more fully with this question.

When a switch opens an arc is formed which, roughly, may be said to be "long" in proportion to the voltage across the arc and "fat" or heavy in proportion to the current passing. Theoretically, an oil switch will rupture the circuit at the instant the voltage wave is passing through the zero point, but in actual practice this is rarely the case, the arc re-building as the voltage rises on the other side of the zero line. The arc itself consists of vaporised oil and metal, which is a much better conductor than oil. A further consideration to be taken into account is the possibility of voltage surges at the moment of switching, which would assist to rebuild the arc.

It will therefore be seen that the length of break must be at least so great as to ensure the final rupture of the arc in spite of the above conditions.

European and especially German practice, seems to be to keep the length of break down near this limit, but both American and English manufacturers employ breaks far greater than are demanded by the above limitations. This is made clear by a study of oscillograph records in conjunction with the switch "Break-time" curves. At the same time this apparently unnecessary length of break is quite a useful feature in increasing the "breaking-capacity" of a switch, as will be seen later.

A more important point, and one very rarely appreciated at its full value, is the effect of a "fat" arc. Even assuming that the current is finally interrupted in the first alternation, the heat generated in that period by its passage through the resistance of the oil and metal vapour, must be dealt with. Bearing in mind that heating effects are proportional to the square of the current, it will be realized that this is a very serious factor. This heat is dissipated in part by direct conduction to the metal contacts. Plenty of metal in the contacts is therefore a distinct advantage. The more important effect, however, is the instantaneous vaporisation of the oil adjacent to the contacts. This may give rise to dangerous pressures in the oil tank. More than one case is on record where the pressure in the tank reached a figure of 100-140 lbs. per square inch.

Again it must be borne in mind that a mixture of oil vapour and air is explosive and sufficient oil must be provided above the contacts to prevent the arc reaching the air above, and to cool the vaporised oil sufficiently to prevent all risk of spontaneous combustion. The most recent designs, both in America and England, embody large air spaces above the surface of the oil, which act as cushions in the event of explosion or violent disturbance of the oil. This air space is confined in a case sufficiently strong to withstand any possible explosive force, and generally a vent pipe is provided to lead the products of combustion away from the switch cubicle.

It will be realized that an exceptionally heavy arc might possibly reach to the tank itself, thus grounding the system. To obviate this risk a baffle of some fireproof insulating material should be used to line the tank, being so arranged as to leave a layer of quiescent oil between it and the metal. This layer of oil should be thick enough to withstand at least double the normal voltage between line and earth.

The question of insulators is now pretty well standardized, as porcelain is almost universally employed on moderate voltages. Mica, moulded under great pressure, has been

used with great success in England. It has much to recommend it on the score of mechanical strength, and when moulded in this way, it is entirely unaffected by oil. For the higher voltages the condenser type of terminal is not only neater, but lends itself much better to sound mechanical design than does the oil filled type of bushing.

References was made above to possible recurrence of the arc due to surge voltages. This phenomenon more frequently gives trouble, however, in breaking down insulation. Especially on small switches it is by no means uncommon to find excellent precautions to prevent arcing from phase to phase, under oil, while the terminals immediately above the tank are brought so close together as to invite trouble. On switches having an ultimate capacity of 10,000 kv.a. and over the practice of employing single pole units linked together by a common operating mechanism is almost universal. In these cases grounding trouble is all that need be anticipated and guarded against.

From the above remarks it will be seen that the suitability of a switch for a given service depends not only on its ampere and voltage capacity but also on its emergency kv.a. capacity. This last function depends on:—

(a) Length of break.
(b) Head of oil above arcing point.
(c) Volume of air above oil level.
(d) Volume of oil surrounding contacts.
(e) Strength of tank and air chamber to resist internal explosion.
(f) Thickness of quiescent wall of oil inside tank.
(g) Weight of metal in contacts.

All these points must be considered when comparing the merits of different switches, in addition to the more obvious points, such as sturdy construction, sound mechanical design and suitable main and arcing contacts. In connection with this matter of emergency capacity, the author would suggest that all manufacturers should establish a convention to rate switches, firstly, by their normal kv.a. capacity, i.e., normal amperes and normal volts, and secondly, by the kv.a. the switch will actually interrupt under emergency without other damage than burnt arcing contacts.

A vast deal of trouble is caused by makers stating the capacity of a switch in so many kv.a. of plant, when it is quite obvious that the plant capacity alone means nothing. What the switch will do is the point, and is the guarantee which is most frequently avoided. In these days the big switch gear firms at least, have had quite enough experience to enable them to give a guarantee that means something definite.

When discussing this subject the writer has frequently been asked how to determine what emergency kv.a. capacity will be required. A few cases will therefore be considered.

With a simple system, wherein a single set of bus-bars is used, to which all generators are connected and from which all feeders run, any switch on the main board may be called upon to break the short circuit current of the whole generating plant in parallel. As is generally known, this figure may rise as high as 20 times normal full load current for a brief period, but will settle down to about three times normal full load, which figure will be maintained as long as the prime movers hold up. Some firms make a practice of increasing the plant capacity of switches which have a definite time lag in operation, assuming that operation is delayed until the peak overload has died down. In view of the fact that the current rush will usually settle down in about .05 seconds, while the switch will not start to move in less than .1 second, it would seem to be a somewhat dangerous policy to make this rule a universal one.

The case of converters or motor-generators working in parallel with the main generating plant, and taking supply from some other source of power, occurs but rarely in this country. The former type of machine is capable of maintaining about eight times normal full load, while the motor-generator set would act as a simple generator at first, but would quickly settle down to possibly 1½ times normal full load. The insertion of a length of feeder or of transformers between the generators and the switch will, of course, limit the possible emergency kv.a. which can flow. In the case of feeders no general rule can be given, but it may be taken that modern transformers, unless specially designed to have high impedance, will permit 8 to 10 times normal kv.a. to pass. Some authorities place this figure down at 3 to 4 times normal, but this seems altogether too low. In any case it is clear that the necessary kv.a. capacity indicated in this way need never be greater than would be the case if no transformers were present.

On the larger plants it is not unusual to break up the busbar system into several independent sections and in this case the total generating capacity behind each section is all that need be considered. This also holds good if the bus-bars are linked by automatic group switches, but if non-automatic switches are used to link the bars the case must be considered as one with a simple bus-bar system.

In place of automatic group switches, or in addition thereto, current limiting reactances in the bus-bars have found much favor of late years. Undoubtedly these devices are of the utmost value in preventing the heavy rushes of current consequent upon short circuits, but their great size makes them awkward to build into the structure, which has to be abnormally large in consequence.

In the writer's opinion the better way to deal with the problem of handling exceptionally large powers is to employ switches having leading contacts which insert a limiting resistance before actually breaking circuit.

Australian Telephones

The telephone systems throughout the Commonwealth are administered by the Postal Department. The extension of the telephone service in Australia is making rapid progress by direct lines and through the adaptation of telegraph wires for telephonic purposes by means of the condenser. The government is spending large amounts from year to year in new equipment and the construction of lines. At the end of 1911, there were throughout the Commonwealth 85,458 telephone lines connected to 927 exchanges. The number of instruments connected was 102,654, giving 2.25 per cent. of instruments to the population.

The cost of the instruments installed and the connections made are (unless in exceptional circumstances) defrayed by the Postmaster General's department. Formerly a specific rate was charged for the hire and connection of a telephone which entitled any subscriber to an unlimited number of calls. In recent years the annual charge was reduced (in some of the states by over 50 per cent) and a further charge is now made for each effective call. Immediately the annual subscription was reduced the demand for telephones—especially for private houses—increased to such an extent that the department was unable to cope with the requirements. The charges for a telephone connection throughout Australia are as follows:—

Population	Radius with main exchange miles	Minimum Annual Charge		
		For an exclusive service	Two party service	Three or more party service
From 1 to 10,000	5	$15.00	$12.50	$10.00
From 10,001 to 100,000 ..	10	17.50	13.75	11.25
From 100,001 upwards ..	10	20.00	15.00	12.50

For all effective calls, subscribers are charged the following additional rates:—

For calls not exceeding 2,000 half-yearly one cent each.

For calls above 2,000 half-yearly, three calls for two cents.

No charge will be made to the subscriber for calls received by him.

The Mystery of an Overcharge

A Story of Fact That Reads Like Fiction—By an Illuminating Engineer

Some years ago, a large shoe concern built a new factory. The factory was to be up-to-date in every way. The architect introduced every kind of improvement he knew of, but, as usual, neglected to give the electric lighting any attention whatever. All that he required off the contractor was, "that lights should be placed where necesary." When the time came around to do the wiring, etc., it was given to the plumber who did the piping, "to be done on time and stock." After events proved beyond all dispute that the plumber was no lighting expert, but credit should be given where credit is due. I have never known another man who had such a faculty for installing incandescent lights like that plumber. He placed lights in all sorts of places—dozens of them. On one sewing machine table, with ten operators, he put twenty-five 16 candle power lamps. In the sewing room which is 56 ft. x 72 ft. he put 164 cord drops five feet from the floor all equipped with 16 candle power lamps, besides 4 old type enclosed arc lamps. The rest of the building was wired in a similar manner. The total load of the building immediately after the plumber had finished was: 632 16 candle power lamps, at 60 watts each, approximately 38 kw.; 4 enclosed arc lamps at 2 kw.; making a total of 40 kw., approximately at 7 cents per kw.h.

The building was opened in November, 1908. The employees worked from 7.30 a.m. to 6 p.m. There was an average amount of daylight. On December 6th the power company presented their first bill from November 3rd to December 1st, twenty-four working days, the amount was $246.81. The company was flabergasted! They sent for the plumber, but the plumber could do nothing. "They'd better take it up with the power company."

They wrote to the power company asking them to test their meter as the amount charged for one month's burning was out of all proportions. The Power Company advised them that the meter was a new one, just from the manufacturer, and bore the Government seal. They were therefore released from all blame for the overcharge.

Time went on—their bills increased every month in the winter time—until March, when it reached the $400 mark. The company grew desperate. They wrote to the Power Company again and asked them to make a test on the meter at their expense. This was done. The Government issued a certificate saying that the meter was 4 per cent. slow on low load and 2½ per cent. high on high load which was allowed by law. The meter went back and the Power Company washed its hands of all responsibility.

In April, 1910, they called in the Big Fixture Company and asked them to go over the building and see what was wrong, and make recommendations to remedy the defects. The Big Fixture Company reported that in their opinion the carbon lamps ought to be changed for new ones. The "T.H." base sockets should be changed to Edison base, and more switches should be installed, this also was done, but the consumption still remained excessive.

In October, 1910, I received a letter from the company stating their case. They wanted to know if I had any record of the cost of lighting another factory about the same size. I referred them to The Blank Glove Company, who had more space and more employees than they had, and whose yearly bill was less than $1,000. Much correspondence ensued. In December they left the case in my hands. All the carbon lamps were removed. In the sewing room 46 60 watt tungsten lamps with "armoured" steel reflectors replaced the old system of 164 16 candle power lamps. The former load was approximately 10 kw.; the new load was less than 3 kw. In the remainder of the rooms 104 Aston Radiant Lanterns with 100 watt tungsten lamps replaced the balance of the 632 16 candle power lamps and 4 enclosed arc lamps.

The ammeter showed 354 amperes on the old load and 124 amperes on the new load, a difference of nearly two-thirds. In December, 1908, the lighting bill was $310.68, for the same month 1909 it was $322.14. After the changes were made, the cost for the month of December was $163.

Needless to say the company was pleased with the results, but even this amount was high, it figured out at nearly $2,000 per year. Yet the load was 10 per cent. less than that of The Blank Glove Company, whose conditions and rate were the same. Somewhere there must be something wrong. Although we were at loss to ascertain the cause of it. The lamps were of the best make. We took care to allow no wastage of light. The meter was tested and sealed by the Government. They refused to make another test. Yet there were enough indications that the meter was registering wrong to devote my time to that instrument.

In January we bought a new meter of the same type and size. This meter also bore the Government seal. It was installed alongside of the old one. On January 24th the old meter registered 4441 kw.h., the new meter registered 2230 kw.h. Here was the whole trouble. The old meter was wrong. It was registering 2 to 1.

We wrote to the Power Company and told them that we were in a position to state definitely that their meter was registering twice as much current as we consumed and we were billed accordingly. We therefore claimed a rebate of 50 per cent. on all lighting bills paid since 1908 when the present meter was installed.

The Power Company advised us that our claim was too unusual for them to consider, and that our contention that their meter was registering 2 to 1 was ridiculous, such a thing was unknown. The meter was 4 per cent. fast as stated by the Government. They ended up by reminding us of their previous letter which stated that they had no further interest in the case. Arbitration followed. After much correspondence it was agreed that a board of three engineers should decide whether the meter was wrong or not.

In the presence of the Power Company's engineer, the manufacturer's inspector and myself the troublesome instrument was removed to the labotory. There we tested out a 60 watt Osram lamp with a lamp tester it showed exactly 60 watts, connected up with our meter for 30 minutes it showed 59 watts or 118 watts per hour. Our case looked good! We made one more test. A 500 watt heater registered 490 watts in 30 minutes. Our claim was accepted. The meter went back to the Government testing laboratory where it was dismounted, and although we were not advised officially what the trouble was, yet I have heard privately that a ten ampere clockwork had been installed in a 5 ampere meter. The dial was the usual 5 ampere size. The clockwork twice its size, hence, the double registering.

As I have stated our claim was accepted. The Power Company handed us back one-half of the total we had paid for light in two years, which amounted to many hundred dollars.

I have in my possession two invoices from the Power Company to the shoe company. One is for light from January 31st to February 28th, 1909, $470.69. The other is for the same month 1910, with three days more burning, from January 29th to March 3rd, $99.90, which is entirely due to an up-to-date lighting system and a correct meter.

This case like many others I know of proves beyond question that a well-lighted building costs less to maintain than a poorly-lighted one.

Testing of Telephone and Telegraph Lines*

A Series of Short Articles Based on the Author's Practical Knowledge and Experience—Applicable to Plant of Any Size or to Any Manufacturer's Equipment

By Mr. T. H. Nicholson

There is a large variety of instruments available that are more or less suitable for telephone and telegraph testing, and it is often difficult for prospective users to know what type is best suited for individual needs and different conditions. Those most generally used may be classified under three general heads, viz., voltmeters, simple Wheatstone bridges and the so-called portable test sets. For rough testing of known troubles, and for routine tests, the voltmeter is by far the best, for the reason that it is self-indicating under certain limitations and it can be arranged with suitable keys to permit of rapid testing. For the actual location of line troubles, however, it is necessary to have some form of Wheatstone bridge, unless a very elaborate arrangement of the voltmeter is permissible, for, as will be later shown, the accuracy of the instrument is only sufficient when connected to a circuit of approximately its own resistance. This, of course, can be accomplished by noting the resistance, as indicated on normal circuits, and cutting into the voltmeter a coil which will shunt it down to that resistance and then taking the corrected reading on the scale calibrated for that particular shunt.

It would be necessary to have a shunt and associated scale for each division of about ten volts, and as such an arrangement would be more trouble than a regular bridge it is rarely so used. Where economy is of great importance a simple bridge can be made up from standard resistance boxes, using the voltmeter with the extra resistance added to the moving coil cut-out for a galvanometer, and even where a regular form of Wheatstone bridge is used this course is recommended. The preliminary test is made with a voltmeter substituted for the regular galvanometer, and when an approximation has been reached the galvanometer is cut back into circuit and the bridge again adjusted to the finer sensibility of this instrument. This method has the advantage of allowing quick testing without the danger of damaging the galvanometer by the excessive currents that might occur on the preliminary tests.

A very convenient form of Wheatstone bridge has recently been developed by several manufacturers, called a "faultfinder" or "ohmmeter." With this instrument it is only necessary to revolve a handle or a knob until a balance is reached, and the corresponding resistance is then indicated directly, thus dispensing with the work of noting and figuring out the various arm values. In some of these instruments the necessary switches are included to arrange the bridge for the various tests usually used, and a table is provided which gives the corresponding values for each test from the figures on the dial. These instruments are rapidly coming into favor on account of their simplicity of operation and flexibility of use.

For measurements on long trunk or toll lines a more elaborate style of bridge is advisable to obtain the accuracy necessary on large gauge wire of considerable length. Like the faultfinder, these instruments are made up in sets that include switches for making the various tests desired, and are generally similar excepting that the operations of the arm units are independent of one another.

For locating trouble in cables preliminary to opening, a still higher grade of instrument is necessary. There is now on the market a wide range of instruments for this work which will be more fully described when that subject is dealt with.

In order to appreciate the reason for the several arrangements of testing circuits it is necessary to know the fundamental principles of the instrument used, so a digression will now be advisable to explain these principles.

The Wheatstone Bridge.

The Wheatstone bridge is the most important instrument used in testing, and a thorough understanding of the principles of its operation will make the explanation of the various tests made with it of greater value. There is no method of measuring resistance directly, any more than there is a method of measuring friction in mechanics, which is an analogous condition, so it is necesasry to compare the effects of the resistance to be measured with similar effects on a known resistance. The most suitable arrangement of resistances for this purpose was first recognized by Christie, but it is to Sir Charles Wheatstone that we owe its development into practical form, hence the name. Fig. 4 shows in conventional form the arrangement of a Wheatstone bridge. A. & B. are two ratio arms, either of which may be made

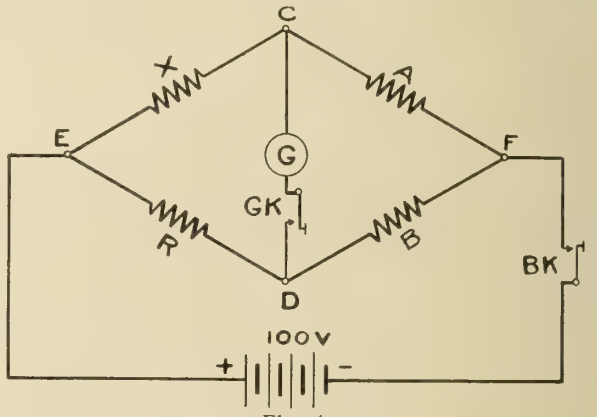


Fig. 4.

10, 100 or 1000 (or combination of these) ohms resistance; R is a rheostat or plug top; X, unknown resistance to be measured; G, galvanometer or voltmeter; BK, battery key; GK galvanometer key.

The Wheatstone bridge is based on the principle that no deflection of the galvanometer will be noted when no difference of potential exists between the points C and D. This condition can only exist when the ratio between X and R is the same as the ratio between A and B. If then A and B are made equal (whether 10, 100 or 1000 ohms is immaterial) and the resistance of R is varied so that we get no deflection of G on depressing the keys (except a temporary deflection which shows the presence of capacity or impendance) we know that the unknown resistance X is the same as R. Similarly if we make B ten times as large or one-tenth as large as A, we know that when we get a balance, the resistance at R is ten times as large or one-tenth as large as X, as the case may be. This latter feature of changing the relative values of A and B is either for the purpose of measuring values of X which are larger than the capacity of R or else of measuring closer than the nearest whole number.

For example: If X is 15792 we make B, 10 or 100 and A 100 or 1000, that is, B is one-tenth of A. A balance will then

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be obtained (approximately) when 1579 is unplugged in R. In this case an exact balance cannot be obtained since 1579 really corresponds to 15790 in X and 1580 to 15800, a difference of 10 in the true value. The only thing to do in this case is to note the deflection to one side with 1579 out and also the deflection to the other side with 1580 out. If they are equal in degree the true value would be half way between 15790 and 15800. If one is smaller than the other, then the resistance which gives the small deflection is the one to use and the true value would have to be estimated as between 15790 and 15795.

If it was desired to measure a resistance very closely, say 15.79, then the ratio of A and B would be reversed, so that A is one-tenth of B. A balance will then be obtained when 1579 is unplugged and, since A is one-tenth of B, the unknown resistance will be one-tenth of R or 15.79. The explanation of the foregoing is as follows:—

Assuming the set-up as shown in Fig. 4, and both battery and galvanometer keys closed, there will be a flow of current from positive battery to (E), where it will divide, part passing by way of X and A to (F), and part by way of R and B to (F), where the two will unite again and return to battery. The strength of current in these two branches will vary inversely with the resistance, but in this case we are not concerned with the actual current strength but rather with the voltage drop in the different parts of the circuit.

Neglecting the resistance of the leads, the voltage between (E) and (F) will be the same as that of the battery, say 100 volts. If now we consider the XA part of the circuit we may conceive of part of the energy or voltage used up in forcing the current as far as (C) leaving the balance to be used in sending the current through the rest of the distance to (F). Thus, if X and A are equal, 50 volts would be required in each part of the circuit. Similarly in the RB part of the circuit, if the two parts are equal, there will be just half the voltage required in each part. Therefore if X equals A and R equals B there will be a drop of 50 volts in either circuit at (C) and (D) and no difference of potential will exist between these points.

The same argument will hold if we assume X to be one-third of A and R to be one-third of B. There would then be the same proportionate drop in voltage in the two circuits, with again no difference of potential between (C) and (D). This being the case we will get no deflection on the galvanometer. It will thus be seen that it is not the actual resistance of the four arms of the bridge, nor yet the fact that X equals A and R equals B that gives a balanced galvanometer, but simply the fact that X bears the same relation to A that R does to B.

This may be expressed thus: $X : A = R : B$
or by the rules of proportion $X : R = A : B$.

It should also be noted in this connection that any resistance which may exist in the battery circuit has no effect on the proportions of the bridge arms, a fact which is made use of in locating grounds and side crosses by the Varley or Murray tests as later described. Neither does it matter what resistance exists in the galvanometer circuit, except that added resistance necessarily reduces the sensibility of the instrument, but this feature is of great value when it is desirable to use a more rugged instrument than that ordinarily used.

The Wheatstone bridge is made in a number of forms, all of which produce the same results as outlined above. The oldest forms is that in which the A, B and R arms are suitable sets of resistance coils connected through some kind of switches in series. This form of bridge was originated by the telegraph department of the British Post Office, and for that reason is generally known as the Post Office or P. O. bridge. A serious drawback exists in this bridge, however, that of the multiplicity of contacts through which the measurement must be made, and this led to the development of the decade type which is now generally considered as the standard arrangement by all makers. In this type the bridge arms are made up of coils all connected at one side to a common conductor, and the other side to a switching device for connecting through. By this means only such coils as are in use have a contact point, and trouble from poor contact is much reduced. Another type of bridge is the so-called slide wire instrument in which the usual variable coil is replaced by one of fixed value, and the A and B arms replaced by one continuous piece of uniform resistance wire. A slider connected to the current supply is moved along the wire until a balance is obtained, and the proportion of wire on one side of the slider to that on the other gives the proportion of the fixed coil to the unknown resistance.

Telephone Extensions in British Columbia

Apart from the large amount of construction necessary to complete the new circuits to Victoria, via Nanaimo, the plant department of the B. C. Telephone Company has considerable work on hand in different portions of the territory in which it operates. The estimate has been approved for the placing of aerial cables, poles and wire in Edmonds and the Burnaby Lake district. This will be connected up to the New Westminster exchange. A 19-gauge cable will be extended out of New Westminster, taking in the district around Deer Lake also. The work is extensive, involving a large expenditure and will not be completed before September, though subscribers' stations will be cut in as progress is made.

A general relief estimate for the whole of the Collingwood territory is in hand, and poles will be placed along the principal thoroughfares in the district.

Laying the duct for the extensions in the West End of Vancouver is now almost completed, and the cable to be installed underground is being manufactured by the Imperial Wire and Cable Company, Montreal. This work will take another month.

In Victoria an extension is being made to the underground system on Pandora avenue, between Belmont street and Verrinder avenue to connect with the present underground system on Fort street. Another extensive piece of work is the removal of two copper circuits now extending over the Sooke Hills, between Victoria and Cobble Hill, and transferring them to the Saanich Peninsula. Owing to the altitude of the route of the line, interruption to traffic has always been threatened, especially in winter when snow lies deep on the hills. Transferring the line will assure an almost continuous service between Victoria and points north on Vancouver Island, as well as with Vancouver.

Fifty additional trunk lines are to be provided in Vancouver by the B. C. Telephone Company between the downtown exchange at Seymour and the Bayview exchange in Fairview. These will be in addition to the large number of inter-office trunk lines, provision for which was made some time ago. With increasing traffic additional facilities are necessary.

Vancouver, on the peninsula between Burrard Inlet and False Creek, is connected with Vancouver south of False Creek by means of a 350-pair sub-marine cable at Granville street, four 200-pair aerial cables at Main street, as well as by other wires on the wholly land section east of False Creek. When the separate exchanges were established at Fairmont and Bayview, one of the 200-pair cables at Cambie street was left unused. It will now be utilized to supply the extra service required at Bayview and also to the new headquarters of the plant department, the building for which on Front street is about half constructed. This structure will be six storeys in height, but even at that will be none too large.

Electric Railways

New Rolling Stock for St. Thomas

The St. Thomas municipal railway system recently placed in service three new double-truck pre-payment cars built by the G. C. Kuhlman Car Company. The cars are illustrated herewith.

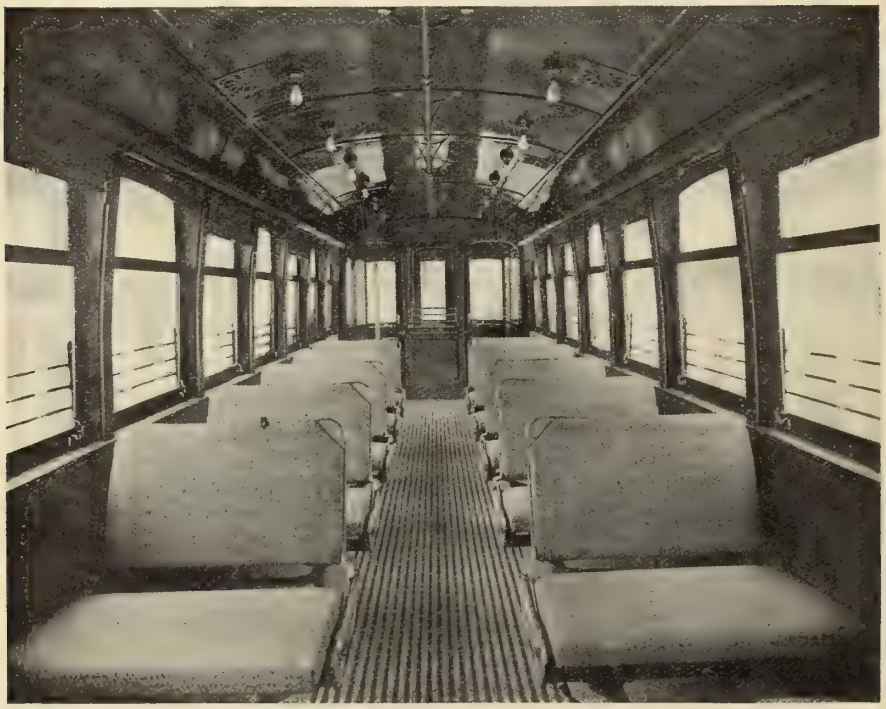
The new cars are mounted on Brill No. 39-E single-motor trucks, having solid forged side frames and pedestal jaws that are integral with the forgings. A steel bottom frame supports the upper structure, in which the ash corner posts are 3⅝ in. and side posts 3¼ in. thick. Eight exhaust ventilators are placed in the Brill plain-arch roof. The roof is supported on ash carlines, reinforced with concealed steel rafters.

There are two prepayment platforms, 6 ft. 6 in. long, separated from the body by bulkheads. Each bulkhead has two sliding doors, with a common central pocket. The cars are arranged for double-end operation, and, therefore, each platform has an entrance and two exits. The combined entrance and exit at the left of the motorman's position is divided by a door post, shown in the accompanying engraving; behind this is another post, reaching from the floor to the hood, and a pipe railing, fixed to this post, extends back to the conductor's position. The openings are fitted with a two-leaf folding door post. A folding step operates in conjunction with the entrance door and on the other side is a sliding exit door and synchronous folding step, operated by the motorman.

The cars are equipped with the Brill semi-convertible window system, in which both sashes, when raised, disappear in roof pockets. The seating arrangement provides for 28 passengers, of whom 20 occupy Brill "Winner" reversible seats, and eight longitudinal corner seats. The roofs are ceiled with three-ply birch veneer and the sides and bulkheads are cherry, rubbed to a smooth, dull finish. Push buttons are provided for signaling motorman and conductor. Sand boxes, alarm gongs, signal bells and other accessories are of the builder's manufacture.

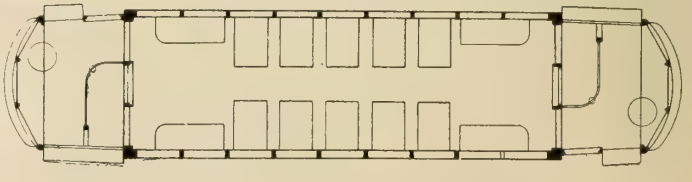


Exterior new St. Thomas cars.



Interior new St. Thomas cars—seating capacity 28.

The specifications of the cars follow: Length over corner posts, 25 ft. 4 in.; length over platforms, 38 ft. 4 in.; length of platforms, 6 ft. 6 in.; centers of side posts, 2 ft. 8 in.; width over sills, 8 ft. 6 in.; width over posts, 8 ft. 6¾ in.; extreme width, 8 ft. 8¾ in.; from side sills over trolley boards, 8 ft. 11⅝ in.; track to step, 15 7/16 in.; from floor to center of headlining, 7 ft. 10¼ in.; step to platform, 14½ in.; platform to floor, 9⅜ in.; seating capacity, 28, type of trucks, Brill No. 39-E; wheel base, 4 ft. 6 in.; diameter of wheels, 33 and 21 in.; weight of car-body, less electrical equipment, 27,380 lb. weight of trucks, 9,560 lb.



Plan of new St. Thomas cars.

Brandon Municipal Railway System

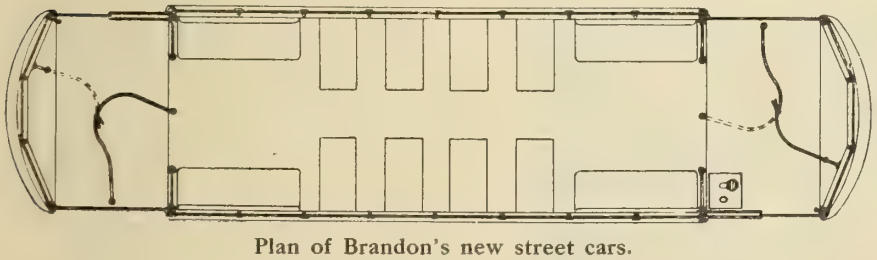
The municipality of the city of Brandon, Man., are just putting the finishing touches to their electric railway system, and expect to be operating part of their rolling stock within the next few weeks. The car bodies are being manufactured by the Niles Car & Manufacturing Company of Cleveland. The trucks are Brill manufacture with 8-foot wheel base and 33 in. rolled steel wheels on 4½ in. A. E. R. A. axles. Five of the ten cars which compose the initial order will be equipped with G.E. No. 80-A motors and five with Westinghouse No. 101-B equipments. Each end of the cars is fitted with an eclipse type fender.

These cars are novel in that they are built with steel underframe and plate trusses extending from the truck to the window sills. This frame consists of two 5 in. steel I beams, full length of the body, which rest directly on the truck frames and are bolted to them. The cross sills are of 4 in. steel channels resting directly on the longitudinal I beams and riveted to them with steel plate gussets. The side sills are of steel angles, 3½ in. x 2½ in. with the short leg resting directly on the ends of the cross sills and riveted to them with steel gussets. The side wall is of ⅛ in. steel plates riveted to the side sills at the bottom and the steel belt rail 2½ in. x ⅜ in. at the top.

The platforms are 6 feet in length and supported on steel angles and channels from the end sills of 8 in. steel channels.



Showing one of Cars on Brandon's New Municipal System.



Plan of Brandon's new street cars.

The right side of the rear vestibule and the left side of the front vestibule are fitted with two pairs of two panel folding doors, with folding steps automatically connected to the doors which are manually operated from the conductor's station only. The right side of the front vestibule and the left side of the rear vestibule have single sliding doors with automatic folding steps, also under manual control and operated from the motorman's station only. Each platform is fitted with reversible iron pipe railings which separate incoming and outgoing passengers and isolate the motorman from passengers at the front end as shown in the accompanying floor plan.

The single arch roof is fitted with four automatic ventilators, having inside ceiling registers. Over each entrance door is a novel combined sign and light for the vestibule. That is, the vestibule lamp is placed in the sign box over the door so that it not only illuminates the sign but also lights the steps and vestibule.

The Brandon municipal electric railway system has been placed under the management of Mr. J. Antonisen, former city engineer of Moose Jaw. The construction stages of the work were in charge of Mr. Bert Greenway.

Crouse-Hinds Unit Resistance

The Resistance illustrated herewith embodies many new and improved features in the construction of Headlight resistance. It consists of a sheet steel frame, removable side plates, end hubs, hangers, resistance units and the various parts required to insure perfect insulation and circuit connections. Its design and construction is such that a damaged resistance unit can be easily and quickly replaced without removing the resistance from the car or disturbing any of the undamaged resistance units. This form of construction eliminates the possibility of damage to the resistance units through leakage from resistance wire to the metal housing. The resistance wire will not rust and is non-corrosive. It can be used in any climate without deterioration and is not affected by moisture. Furthermore, it will withstand extreme high temperature without oxidizing, scaling or becoming brittle.



Fig. 1.—Removable Unit Resistance, Complete.

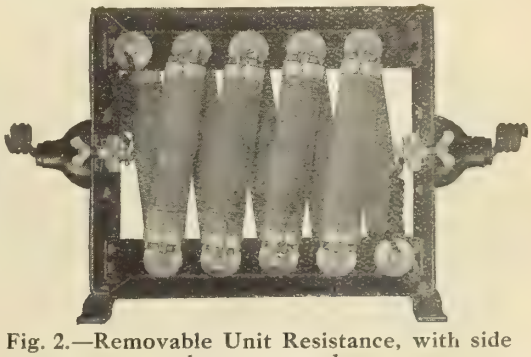


Fig. 2.—Removable Unit Resistance, with side plates removed.

The time involved in repairing is reduced to a minimum, as, after one or both of the side plates have been removed, Fig. 2, the defective units are readily detected and new ones substituted, without taking the resistance apart. A unit is easily removed by loosening the connecting nuts that clamp it at each end. The resistance is adapted to either open or conduit wiring, as the end hubs, in addition to being tapped for ½-inch conduit, are provided with bushings, which can be removed easily. This equipment has been devised by the Crouse-Hinds Company and is now being placed on the Canadian market by the Crouse-Hinds Company of Canada, Ltd.

Illumination

Proper Gymnasium Lighting

Gymnasium activities are largely carried on by artificial illumination, especially in Y. M. C. A. organizations and the playground parks of our large cities. The benefits of the exercise will therefore be in a very direct way proportional to the satisfactory character of the lighting system employed. Instructors of gymnasium classes are in a position to judge good and bad lighting, to observe its influence upon the spirit of the game, and its tendency to produce fatigue as a result of eye strain.

The man in charge of the gymnasium illustrated herewith said that since improving the lighting conditions, the boys are livelier, take a newer interest in their play and enter into the contests with much more spirit. Before the new lighting units were installed, misplays in many of the games were very frequent. The cause of this is directly traceable to the poor lighting conditions since the open lamps were blinding and the poor distribution of light caused an indistinctness of objects used in the play. Good lighting has increased ocular comfort, seeing power and accuracy.

There are several playground park gymnasiums operated under the supervision of the West Chicago Park Commission, and as an example the men's gymnasium of Holstein Park is illustrated, Fig. 1. This gymnasium is 36 ft. wide and 60 ft. long with a balcony at one end projecting about 8 feet into the room. The general arrangement of lighting units as indicated by the plan, Fig. 4, and section Fig. 2 shows twelve outlets 20 ft. above the floor and about 8 feet from the side wall. X-Ray Bee Hive reflectors, Fig. 3, which, as shown, are enclosed in coarse wire baskets, Fig. 5, provide perfect illumination for the room. With one 150 watt lamp for each reflector the total wattage is 1800 or .83 watts per square foot. The particular reflector installed comes down well over the lamp and thus shields the filament from view, preventing glare.

The interior view of this gymnasium brings out several interesting points. The photograph was taken by the artificial light only, no flash lighting being employed, and those familiar with photographic processes will readily appreciate that a comparatively long exposure is required under artificial lighting, to bring out distinctly the dark walls and apparatus. The clear definition of detail indicates that there is plenty of light in the room and that it is properly and evenly distributed. It will be noted also in the photograph that there is a remarkable absence of halation or glare about the units. This is accounted for only by the fact that a direct view of the lamps is almost entirely cut off by the

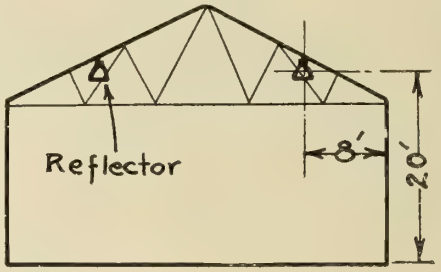


Fig. 2



Fig. 3



Fig 1.—A properly illuminated gymnasium

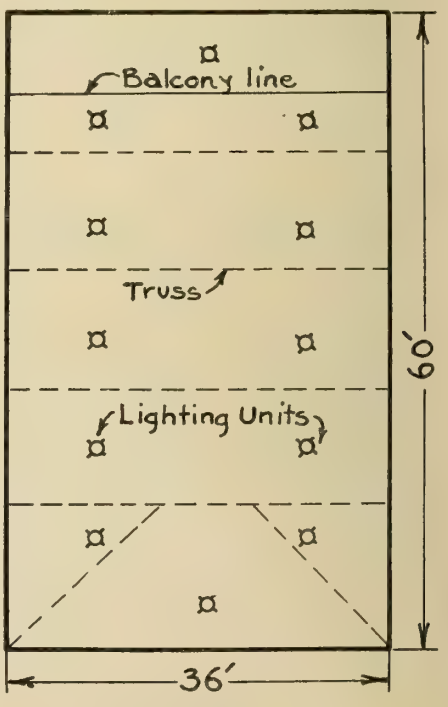


Fig. 4

deep reflector. Bare lamps or partially shaded lamps would appear in the picture as glaring lumps of light.

The wire guards mentioned above protect the reflector from damage by balls and swinging apparatus, and their presence does not affect the lighting results. The guards are constructed of No. 10 wire and are circular in form, they are very substantial and rigid. The fastening of the guard is independent of the reflector support. This practice will prevent any vibration or jar, due to striking of the wire, being transmitted to the lamps and reflector. The basket

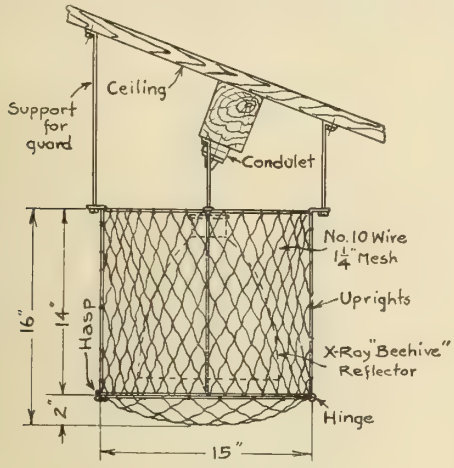


Fig. 5

protectors of this installation are repeatedly hit by basket balls and indoor base balls, but no breakage of lamps or wire protector can be opened, thus making the lamps and reflectors easy of access for cleaning and renewals.

The Bee Hive type of reflector has been adopted by the West Park Board of Chicago, after trying out several types of units, and in eight of the playground gymnasiums this reflector replaces systems which used four lamps bunched at the outlet. A saving in wattage has resulted and also a very large increase in the effective illumination. The eight gymnasiums are practically duplicates of each other so that the above description is equally applicable to all.

Personals

Mr. H. E. M. Kensit, who has for some time past been attached to the Water Power Branch of the Department of the Interior, has now been appointed city commissioner at Prince Albert, Saskatchewan.

Mr. W. E. Goring, assistant sales manager for the Hamilton Electric Light & Power Company, represented his company at the annual convention of the National Electric Light Association held in Chicago, June 2nd to June 6th.

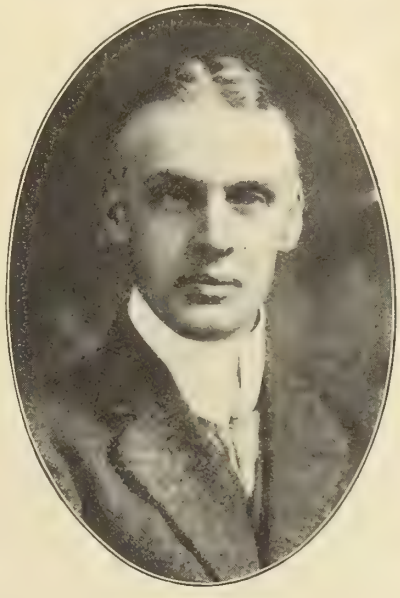
Mr. Thomas Ahearn, president of the Ottawa Electric Railway and Ottawa Electric Companies, accompanied by Mr. James D. Fraser, secretary-treasurer of the former company, and Judge D. B. MacTavish of Ottawa, sailed June 24th for Liverpool. Mr. Ahearn is taking his own motor car, and with Mr. Fraser and Judge MacTavish will motor through the United Kingdom. They will return home about the middle of August.

Mr. John S. MacLean has been appointed to take charge of the publicity and advertising work of the Canadian General Electric Company, Limited, and of the Canadian Allis-Chalmers, Limited, with headquarters in Toronto. The latter company in addition to manufacturing an extensive line of machinery and appliances will also act as sales agents for all the products of the Canada Foundry Company, Limited. Mr. MacLean held a similar position with Allis-Chalmers-Bullock, Limited, for a number of years.

Mr. R. H. Nichols, Canadian representative of Messrs. Evershed & Vignoles, Limited, of Acton Lane Works, London, Eng., has just returned from a two months' business trip in England. He reports that business generally is very brisk and as evidence of this his principals have been compelled to double the size of their plant within the last two years and are still extending. In the Megger department alone they had over four hundred instruments on order as well as having in hand the work of providing the electrical instruments for at least six of H. M. battleships now in course of construction.

Mr. Arthur S. Herbert has resigned his position as general manager of the Siemens Company of Canada, and has been appointed general manager of the branch offices of the Siemens Company in Australia. Mr. Herbert is now in England, but will return to Canada for a few weeks early in July, sailing for Australia from Vancouver about the end of August. He will be succeeded in Canada by Mr. C. A. Ablett, whose name has been closely associated with the electrification of rolling mills in Europe during the past few years, and who recently made a brief investigation of the position of the large steel works of Canada with regard to electric drive. Mr. Ablett will take up his duties in Canada early in July.

Mr. P. T. Davies, the first president of the Montreal Electrical Society, was on Saturday, June 21st, presented, on behalf of the members, by Mr. T. H. Nicholson, the new president, with a gold watch fob. The presentation was on the occasion of the society's first summer visit to the Mount Royal tunnel of the C. N. R. The fob is inscribed with the society's emblem. Mr. Davies was born in South Wales in 1882, and after a private education, began his business career with the Uskide Engineering Company, Newport, Mo. Later he joined the staff of the South Wales Electric Power Distribution Company, and in 1907 came to Canada, entering the



Mr. P. T. Davies

employment of the Montreal Light, Heat and Power Company. From 1909 to March, 1913, he was operating superintendent, and in 1911 he was also appointed chief power agent. In March of this year, Mr. Davies relinquished the first position, and while retaining that of chief power agent was also made assistant to Mr. R. M. Wilson, general superintendent and chief engineer. It will be seen that Mr. Davies has made very great progress in his profession since he came to Canada. He is exceedingly energetic, and it was due largely to his efforts that the Montreal Electrical Society made such rapid growth during the first year of its existence.

The Dealer and Contractor

Control of Stationary Suction Cleaners

The accompanying illustrations represent the correct method of wiring up for a stationary suction cleaner operated by alternating current motor. Fig. 1 shows a 3-phase motor operated from one point only, which is generally in the basement close to the motor. Fig. 2 represents a 2-phase, four

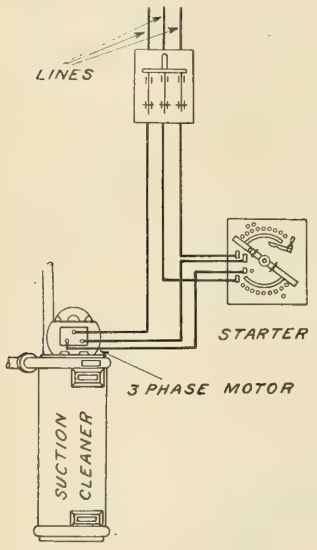


Fig. 1

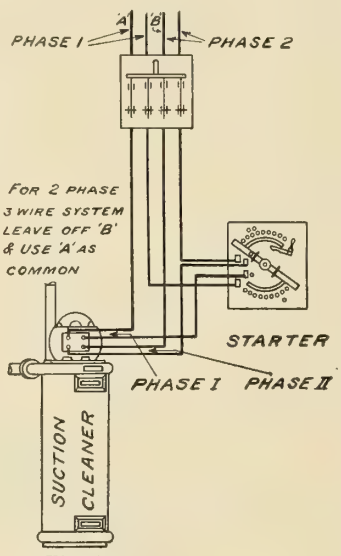


Fig. 2

wire system, operated through an automatic starter, also from one point only. For 2-phase, three wire arrangements, leave off the line marked B and use the line marked A as the common return.

The Hydro-Chronograph

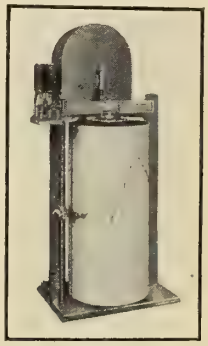
With the increasing developments in water and water-power plants and the consequent increasing need for water conservation there has arisen the necessity for accurate data on the flow of streams and rivers over varying periods and at various seasons of the year. The collection of this data has always been attended with more or less difficulty and inaccuracy on account of the lack of proper instruments, and we describe and illustrate herewith a new equipment for registering the fluctuation in water level in a river or reservoir which seems to be a decided step forward in the manufacture of this type of equipment. This apparatus is known as a Hydro-Chronograph and is manufactured by the Hydro Manufacturing Company, of Philadelphia. It is already in use in various parts of the United States and Canada, including Prince Rupert, B.C., Sault Ste. Marie and Niagara Falls, and is now being installed by the municipality of the town of Swift Current.

The Hydro-Chronograph proper is an instrument with a clock-driven drum which makes one revolution in twenty-four hours, seven days, or thirty-one days, as may be desired. The record is made with a recording pen which is operated by a float, the reducing mechanism being bevel gears and a four-thread screw. Primarily this device was intended to be located at the point registered, but the manufacturers have succeeded in applying an adaptation of electric telegraphy by which it is not only possible, but entirely practicable, to have the instrument itself in the office of a manufacturing plant or municipal pumping station and record the condition of river or reservoir several miles away; which, for instance, in the case of a pumping station, would keep the engineer constantly in touch with the conditions at the reservoir and thus enable him to regulate his pumping accordingly, cutting out probably 90 per cent, of waste pumping.

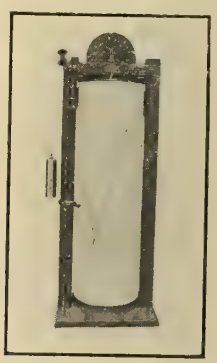
This long distance feature is worked out by a simple device, worked by the float, which operates a standard telegraph key whenever the water rises or falls a fraction of an inch. The contact thus made closes a standard telegraph relay in the immediate neighborhood of the instrument, throwing into circuit a relay or local battery which operates a solenoid on the instrument, ratcheting over a wheel one tooth in either direction whether the water is rising or falling. This is so simple and substantial that there is very little opportunity for casualty of any kind.

In hydro-electric work there is a special type of Hydro-Chronograph designed which makes two records on one card, the upper portion being the record of the head water and the lower portion the record of the tail race. This type, as well as all other forms of the Hydro-Chronograph, can be operated from a distance if desired.

Still another type is the Hydro-Chronograph Weir Gauge which is remarkable inasmuch as it will make a record through a maximum of two or three feet without any reduction or on a reduction two to one through a variation of four or six feet. This, of course, means that an enormous card is used, this being two or three feet wide and in point of time being for 28 hours, 7 days or 28 days; but the



Long Distance Hydro-Chronograph

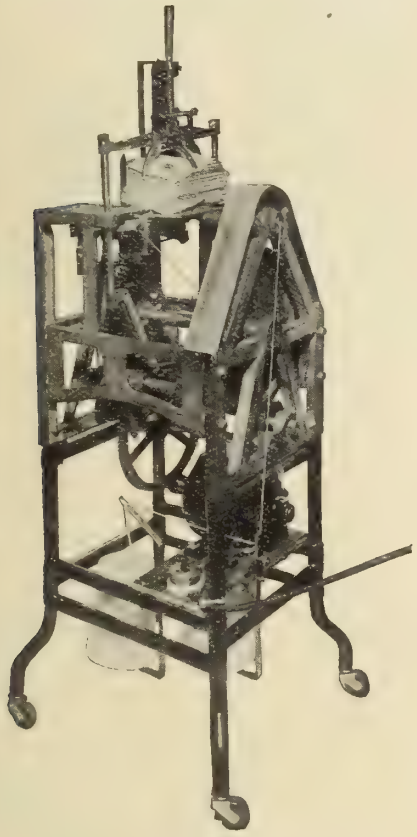


Hydro-Chronograph Weir Gauge

record thus obtained shows the slightest variation in the water level of a weir. This type has been found extremely useful and valuable not only for weirs—for which it was designed—but also for work of sewage departments in cities where the flow is tabulated by means of these records.

Automatic Package Tier

A few seconds saved in operation that must be constantly repeated mean many minutes by the end of the day, and the saving of minutes often means the saving of many dollars in the busy office. That is the reason why small motor driven machines are being used so extensively in modern business houses for operations such as sealing and stamping envelopes, opening letters, running adding machines, duplicators, addressographs, etc. One of the latest of these time and labor saving devices to make its appearance is the automatic package tier. It is designed primarily for tying mail matter into packages, but has many other applications besides. It takes bundles of from 25 to 50 letters, and in 2½ seconds binds them into a neat, compact package and



Another small motor application.

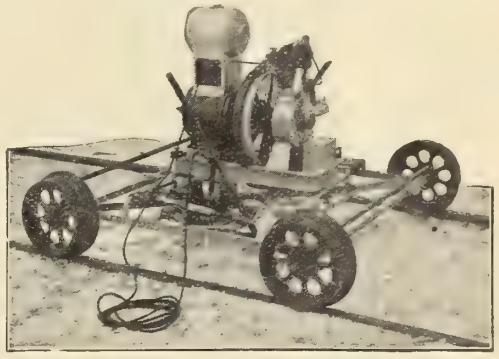
drops them into the mail bag or other receptacle. Where much mail matter is handled, it permits a reduction of the clerical force and enables earlier mails to be caught. The machine is made by the Automatic Package Tier Co., Chicago. It is operated by a 1/8 Westinghouse small motor which takes current from the lighting circuit.

Secondaries "Must" be Grounded

The "1913 National Electrical Code," of the National Fire Protection Association, will be issued in about two months' time. At the annual meeting of the association, held in New York at the end of March, the code was revised, alterations and additions being made to the code issued in 1911. The most important alteration is to Rule 15, where the word "may" is changed to "must," the rule now reading "Transformer secondaries of distributing systems must be grounded provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts; and may be grounded when the maximum difference of potential between the grounded point and any other point in the circuit exceeds 150 volts." A new table of the carrying capacity of wires has been compiled, increasing the current to be carried; while new rules for garages have been added to the code. The Canadian Fire Underwriters' Association, Montreal, are having the code translated into French for the benefit of French-Canadian electrical contractors.

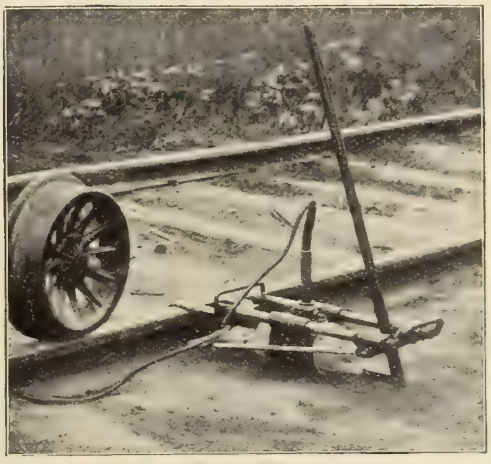
Electric Bonding Outfit

An apparatus specially designed for furnishing electric current for the operation of Duntley electric drills for the rapid drilling of holes for signal bonding of steel railroads is shown in the accompanying sketches. The generating equipment consists of a single cylinder four cycle gasoline engine, direct connected to a 1¼ kw. generator wound for 125 volts. The engine and dynamo are direct-connected and mounted on a welded steel frame made of 3-inch channel steel and when detached from the truck can be provided with two pipe handles so that the entire outfit can easily be car-



Gas-electric unit on truck.

ried by two men. The generating unit, however, is usually mounted on a four wheel truck with welded channel steel frame and supplied with pressed steel wheels, this truck having a wheel base of 50-in. The weight of the four-wheeled truck with generator, is approximately 500 lbs. The engine develops about 5 h.p. at a normal speed of 1500 r.p.m. The generator is compound wound to take care of excessive loading, and the shaft is supplied with ring oiling bearings. The switchboard has a provision for making connections to two electric bonding drills. A fuse block is enclosed in the switch case and lock, and covers are provided so that the entire switchboard may be locked up. This generating outfit is



Drill operating in adjustable frame.

capable of operating two bonding drills simultaneously. The drill itself is mounted on an adjustable frame as shown herewith, hooking over the rail to be drilled and can be applied or removed in a few seconds. It is possible to drill 30 to 40 rail joints, four holes per joint, per hour, with each drill. This equipment is manufactured by the Chicago Pneumatic Tool Company.

Reminder Clocks

An unique and interesting improvement in clocks has just been brought out by the Darche Manufacturing Company of Chicago, in their "Reminder" clock. This clock will be of value in offices, factories, hotels, garages, schools, stores, etc. The placing of a plug in a hole opposite to such time as one may wish to be reminded of an appointment, a telephone call to be made, or any other special duty to be performed, will cause a buzzer to sound at the time



Reminder Clock

plugged and, the buzzer will continue to sound until the plug is removed. The clock has an eight-day movement. The buzzer is operated by a dry battery, both being concealed in the clock. This reminder clock is mounted as shown, or in a wall case 22 x 30 in., with a blackboard or plain surface and furnished with a 6-inch alarm bell.

Magnetic Disc Brakes

Accessibility of parts is a very important feature in multiple disc brake construction. This feature is one of the advantages of a new type of magnetic disc brake manufactured by the Cutler-Hammer Manufacturing Company, and shown in the accompanying illustrations. With this type, to remove or replace a disc, it is not necessary to remove the brake from the shaft and practically dismantle it, but the mere loosening of three bolts which secure the magnet coil in place will give access to the interior and the discs can then be slid out along the shaft and easily replaced. The brake itself is left secured in place. This design also provides for ventilation; the rotating discs shown in the exposed view, Fig. 2, have cored radial passages similar to those in the runner of a centrifugal pump. When set in motion air is drawn in through inlet passages in the hub and ejected from outlets provided in the side of the disc—enclosing frame under the cover. The good ventilation secures better capacity and wearing qualities. No lubrication is required.

This new line of brakes is rated in h.p., maximum torque in pounds-feet, and capacity in feet-pounds per minute. For different kinds of service, such as for crane hoist, screw-down of a rolling mill, etc., the particular brakes suited to the requirements can be selected.

Structurally, these brakes consist of a hub; a series of stationary and rotating discs; an enclosing case; a spiral spring and an electric-magnet. The hub, which is mounted on the shaft, carries the rotating discs. These are interleaved between the stationary discs which are anchored to the enclosing case. The stationary discs are faced with a product having a high coefficient of friction and the rotating discs have internal radial air passages. Normally, the stationary and rotating discs are engaged by means of a spiral compression spring. The electric magnet serves to compress this spring and release the pressure on the discs when it is desired to remove the brake. The intensity of the brakeing force can easily be adjusted, the brake application and release being made without shock or hammer. The actuating forces are balanced within the brake so that there is no end thrust imposed on the shaft to which they are attached.

In Fig. 2, 102 represents the magnet case; 104, the armature plate; 105, the hub; 107, end stationary discs; 108, rotating discs; 109, intermediate stationary disc; 110, friction lining; 112, brake frame.

Electricity in the Manufacture of Jewelry

Many claims are justly made regarding increased production and economy in power consumption resulting from the use of electric drive. Not only is there an ecenomy in friction losses, but the ability to work a tool at its maximum capacity and the fact that power is being consumed only when work is being done are also most important considerations. The latter fact should receive great consideration from the manufacturing jeweler, as the length of time he uses his machinery must necessarily be short. One of the greatest advantages of electric drive is its flexibility, which quite readily affords small sub-divisions of power so that it becomes practicable to use motors either for individual tools or to drive groups for a sequence of operations.

Due to the varying conditions to be met in different factories, it is impossible to make any general recommendation that would be applicable to any special installation. An intimate knowledge of the manufacturing processes to be served is quite as necessary to the designer of an electric drive as to the manufacturer himself. These are matters that require special knowledge and experience. Many manufacturing houses make a specialty of studying the requirements of these situations and their advice should be sought before installations are made.

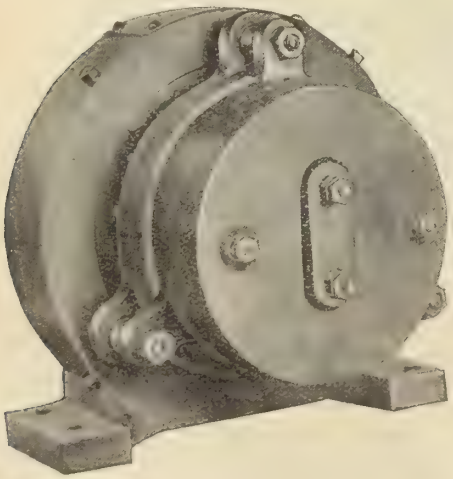


Fig 1—Rear view of magnetic disc brake

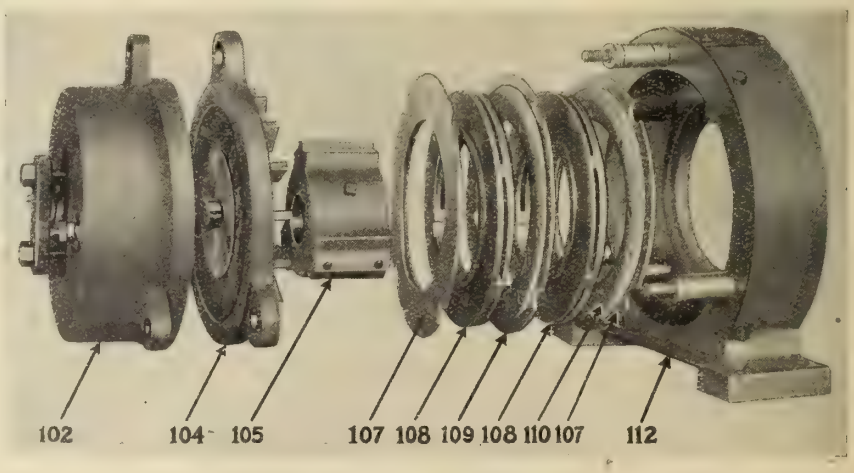
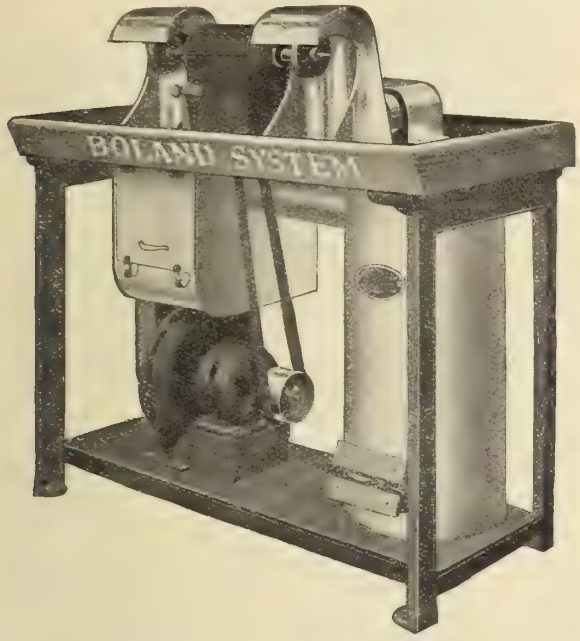


Fig. 2—Exploded view, magnetic disc brake

Among the many manufacturing concerns who have made special investigations into the application of small motors is the Holtzer-Cabot Electric Company, who have just issued a booklet dealing with the adaptability of motor drive to the requirements of the jewelry trade. The booklet contains also a number of illustrations showing motors operat-



Electricity in the Jewelry trade

ing polishing benches of various sizes, the polishers being driven either individually or in groups; buffing and grinding equipments of various kinds; scratch brushes; hot blast drying apparatus; positive pressure blowers; lap wheels; breaking down rolls; bench drills, etc. The booklet also describes and illustrates dynamos and their auxiliary equipment for electro-plating work.

Electric Arc Welding

The day appears to be passing when ordinary defects, such as shrinkage, cracks, blow holes, etc., in expensive castings necessitate the making of another casting; or when a crack in a street car truck or a brake of a locomotive train means the keeping of the car or locomotive out of service while a new part is being manufactured. Defects such as these can now be quickly and comparatively cheaply repaired by welding.

The C. & C. Electric & Manufacturing Company are placing on the market an electric arc welding equipment, which is claimed to differ from other forms of welding, in that by using an electric arc to produce a high temperature, the two pieces of metal to be joined are actually melted and flow together into one piece, instead of being merely softened by heat, and then caused to unite by the application of pressure or by hammering. It will thus be seen that the metal really becomes continuous and homogeneous. The electric arc permits the welding also of such metals as copper, brass, etc.

The heat given by the electric arc in this equipment is most intense, being about 4,000 deg. C., which is sufficiently high to reduce most ordinary metals to the liquid state and has the further advantage that, being applied quickly, the conductivity of the metal cannot carry the heat away fast enough to lower the temperature at the point of welding. This explains how the electric arc can be applied to as small an area as desired without dissipating heat over the whole work, which, in the case of a large casting means a very great loss. Further, the equipment is easy to manipulate, requires no complicated apparatus or previous preparation for the work in hand and it is claimed to be the cheapest method so far devised for obtaining such high temperatures on a commercial scale. There is also a large factor of safety associated with the use of this equipment; there is no danger from explosives and only low voltage currents are used; no hurtful gases are given off.

The apparatus necessary in one of these complete electric welding sets is (1) A driving motor direct-connected to (2) a welding generator, (3) a switchboard on which is mounted the necessary control apparatus, (4) electrode holders, (5) face and hand shields for operators.

An idea of the cost of making ordinary repairs can be gathered from the following data, showing how this welding outfit turned out work in one electric railway repair shop. The column giving costs is figured out at 2c per kw.h. for current and 30 cents per hour for labor, but it can readily be figured out what the different operations will cost in any



Showing operator with one type of head shield and combination electrode holder for both metallic and graphite electrodes

shop by using the figures in column (1) and (2) and substituting proper costs for labor and power.

	Time.		kw.	Average Costs.
Gear case lugs	10	min.	6	$ .07
Armature shaft (broken) 2-in.	60	min.	20-30	.80
Dowell pin holes	5-12	min.	4-8	.07
Broken motor cases	2½-3½	hrs.	75-90	4.98
Broken lugs on a compressor cover, doors and grease-cup hinges	2-5	min.	1-3	.03
Broken truck frames	30-60	min.	20-35	.63
Worn bolt holes in motors and trucks	5-10	min.	3-5	.05
Enlarged and elongated holes in brake levers	2-4	min.	1½-3	.03
Armature shafts, 2-in. worn in journals	2-3	hrs.	60-90	3.75
Armature shafts, worn in key-ways	10-15	min.	7-12	.10
Armature shaft, worn thread.	20-30	min.	10-15	.24
Air brake armature shafts (broken)	20-30	min.	10-20	.27
Leaking axle boxes	5-15	min.	3-7	.08

Northern Boltless Guy Clamps

The Northern Electric & Manufacturing Company have purchased from W. N. Matthews & Company, St. Louis, Mo., the patent rights for Canada on the "Matthews Boltless Guy Clamps," and are manufacturing these in Canada under the name of Northern Boltless Guy Clamps. Primarily the boltless guy clamp was designed to eliminate the cumbersome, time-consuming process of attaching guy and span wires to poles and anchors. Since it has been in actual service numerous other advantages have been found which alone made its use worth while. The Northern boltless guy clamp is manufactured in two sizes, the "Giant" for guy strand 5/16 in. and 7/16 in. in size, and the "Baby" for use



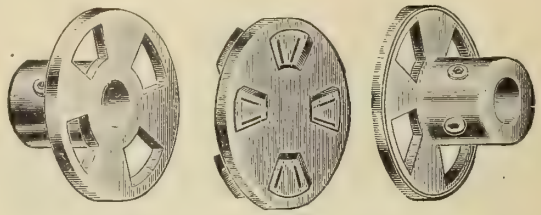
Boltless guy clamp.

on ¼ in. and 5/16 in. strand. In principle the clamp is simple. It consists of a wedge grooved on one side and smooth on the other, which fits into a tapered sleeve with internal grooves on one side. These grooves on the wedge and sleeve when mated form for the strands a pair of channels which are gradually reduced in section as the wedge enters the sleeve.

To apply the clamp, the span or guy strand is run through the sleeve, thence around the pole or through the eye of the anchor and back through the sleeve. The wedge is then inserted in the sleeve, and as it is driven tight it wedges the wire securely the two sections of strand filling the grooves. The double groove, in the sleeve and wedge permits clamping without deforming the strand, and as the tension in the strand comes as much from the section in direct line with the guy as from the one forming the stub end, the clamp can be set in either direction according to convenience in driving the wedge. The time required to apply the clamp after the slack has been taken up in the strand is almost negligible, most of it being consumed in detaching a short section of wire from the strand and giving this a few turns around the guy to make the connections neat in appearance. Another advantage which has developed through actual service is the ease with which sags may be taken up in new line while the poles are assuming a permanent set. This is accomplished by applying a "come-along" and small block and fall between the span wire and the pole and after the slack is taken up the wedge is removed, thus allowing the slack to pass through the sleeve. The wedge is then reinserted and driven tight.

Flexible Insulated Coupling

The Canadian Bond Hanger and Coupling Company, Limited, of Alexandria, Ontario, announce that they have secured the sole rights to manufacture and sell the Grundy Patent Flexible Insulated Coupling for Canada. The Grundy coupling has been sold in England and the United States very extensively, for the last two or three years. It is one of the newest devices on the market in the way of a flexible insulated shaft coupling, and is designed for the transmission of power from one shaft to another, where electrical insulation and a moderate degree of flexibility are desired. The two outside flanges can be either keyseated or set-screwed to the ends of the shaft. The central disc is made of special selected leather and has lugs securely cemented and riveted to each side; the disc supplies the insulation and the lugs transmit the power to the outside flanges. The Canadian Bond Hanger and Coupling Company, Limited, claim that this coupling will transmit more power than any



Grundy flexible insulated couplings.

other coupling of equal diameter, and that it will sustain uneven shocks. Where it is not possible to secure perfect alignment of shafts, the coupling will adjust itself to any such inequalities. These couplings are made in sizes from 3-in. in diameter to 30-in., so that they are applicable to small machinery, and also for the largest units. The Grundy can be run in either direction, at high or low speeds, and is claimed to be specially well adapted for connecting engines to generators, motors to pumps, sewing machines, machine tools, printing or wood-working machinery, etc.

Combination Fan & Lighting Unit

One of the most novel improvements in car lighting fixtures of recent date is a combination gyrofan lighting unit as shown in the accompanying illustration. This type of unit entirely relieves the congested appearance of the upper deck of the car. The gyrofan is placed directly over a lighting unit and revolves about the centre stem of the fixture as an axis. The type of bowl used in this installation is one specially designed for uniform distribution of light, but different effects, possibly more pleasing, may be



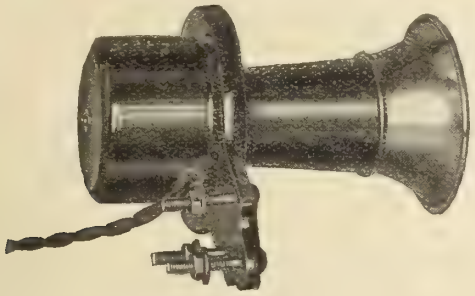
Gyrofan for railway service.

obtained, by varying the glassware. This unit has been designed by the Adams-Bagnall Company for use in a Lake Shore diner. The unit is about 16 inches in vertical measurement. One of the points of advantage claimed for the unit is the fact that the fans are placed above the lighting fixture so that there are no flickering shadows caused, either when the fans are in motion or at rest.

The Eugene F. Phillips, Electrical Works announce that owing to increase in business they have moved their Winnipeg office to more commodious quarters at suite 602 Electric Railway Chambers. Mr. W. H. Reynolds is western manager for this company, with headquarters at Winnipeg.

A Stop-Look-Listen Horn

The illustration herewith represents an electric automobile trumpet manufactured by the Adams-Bagnall Electric Company and being placed on the Canadian market by Mr. R. E. T. Pringle. The trumpet is operated by an electric

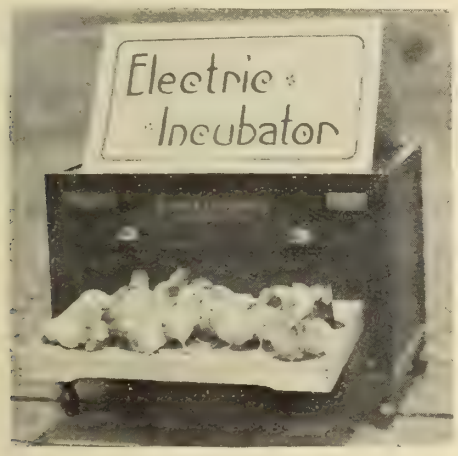


Stop-look-listen horn.

vibrater, which works on the same principle as an interrupter in an induction coil, or the vibrating armature in an electric bell. The construction features include (a) sterling silver contacts, (b) phosphor bronze main spring which will not rust or change its tension, (c) hard steel diaphram, (d) pin rivetted to diaphram, (e) no exposed binding posts or screws, (f) no loose wire leads from coils, (g) a novel method of adjustment. On account of its effectiveness this trumpet is known as the Stop-Look-Listen horn.

Electric Incubators

Considerable interest was aroused in poultry fanciers' circles at Vancouver recently by the spectacle of a brood of downy chicks which were hatched out in an electric incubator, placed in the show room of the B. C. Electric Rail-



Chicks, 24 hours old.

way Company at the corner of Carral and Hastings streets. The eggs reposed in the incubator for a period of three weeks, and true to nature the chicks appeared on the day assigned for the hatching to take place. The heat is provided by electric current, a thermostat regulating the temperature so that but little attention is required in operating the incubator.

Wood oil is produced from the nuts of the "tungshu" tree of China, and practically the entire supply comes from that country. Its normal price is 2s 6d.—60 cents—per gallon, and in the fiscal year ending June 30th, 1911, the United States imported 5,000,000 gallons. The wood oil tree will grow along the Pacific Coast, south of Sacramento, and in the Gulf States. Another source of supply is the Kukui nut or candlenut, which grows in Hawaii and the Philippines. If the nuts can be gathered and the oil extracted profitably this oil should compete with Chinese wood oil.

New P & S Devices

The Pass & Seymour Company have just made a number of important additions to their line of handy wiring devices, as illustrated in the accompanying figures: Figures 1, 2 and 3 are key, keyless and pull type receptacles respectively, for use with condulet base; figures 4, 5 and 6 are key, keyless and pull type receptacles respectively for use with wood moulding or Paiste type taplets; figures 7, 8 and 9 are key, keyless and pull type receptacles respectively for use in open wiring. All of these nine receptacles embody the Fluto style interchangeable shell. This Fluto shell, as used on these receptacles, is interchangeable with the entire P. & S. line of Fluto sockets and receptacles.



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.

Fig. 10 represents a pull receptacle exclusively for use on 4 in. boxes; in the past it has been the practice to use, on outlet boxes, a pull receptacle which was primarily designed for use as a wall receptacle. The porcelain projecting ring of this new type insulates the metallic shell from the box and from the ceiling, thereby permitting its use on metal ceilings. This receptacle is regularly supplied with pull chain 18 inches long, but may be supplied on special order with chain of any length or, if desired, with a silk cord in place of chain.

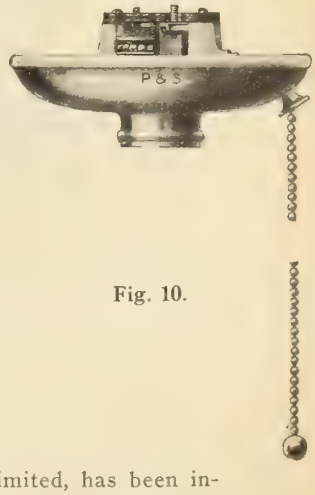


Fig. 10.

The Innisfil Telephone Company, Limited, has been incorporated with a capital of $12,000, to carry on the general business of a telephone company with head office at Lefroy, The provisional directors are Ebenezer Todd, W. J. Ralston, and G. C. Allan, all of the township of Innisfil, County of Simcoe, Ont.

Electric Irons

What are the desirable qualities of an electric iron? To this question an expert housewife replies.

1. That it shall be perfectly free from any liability to shock or burn the operator.

2. That it shall be suitable for ironing all classes of material quickly and well.

3. That it shall have a long life, and be of such construction that it can be easily repaired, if necessary.

To meet such demands a small army of heating device experts in the various factories of the leading electrical manufacturers have spent much time in research and experiment. A host of types and styles have been developed, and

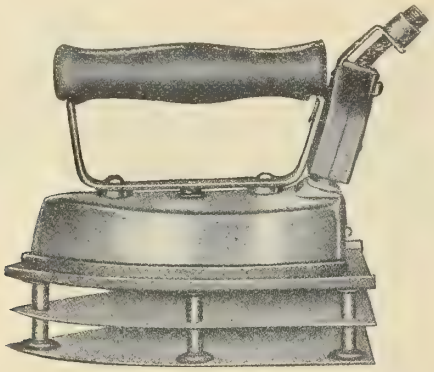


Fig. 1.—Iron with special stand.

quickly superseded by superior designs. This process of survival of the fittest has gone on for some years, special effort being concentrated on the household iron, which now possesses the qualities called for by the most exacting operator. Among the very latest products, is one offered by the Canadian General Electric Company, and known as their Type F-13. F-13A (Fig. 1) shows this iron on a special ironing stand; F-13B (Fig. 2) is equipped with a permanent heel stand. Attention is drawn to the following points in construction and finish.

1. A one layer calorite leaf heating unit, thoroughly insulated with sheet mica, and in intimate and even thermal contact with the working body of the iron. Calorite melts

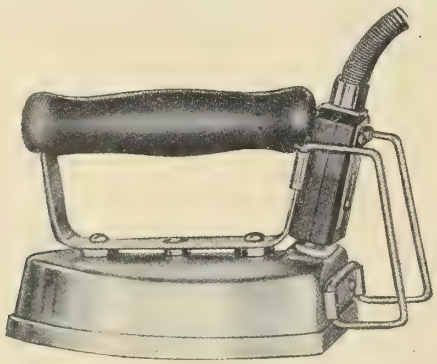


Fig. 2.—Iron with heel stand.

at 2370 deg. Fah.; that is, ten or twelve times its working temperature.

2. A shell cover, providing a dead air space over the top and around the sides of the iron, effectively cutting off heat radiation from the operator's hand.

3. A heel stand can be permanently attached, on which the iron is rested when not in use. No separate stand being required.

4. Heavily insulated and protected cord attached to a contact plug, constructed so that loose connections are impossible.

5. A barffed finish has been found most satisfactory for the actual ironing surface. All other parts heavily nickel plated, give the iron a very attractive appearance.

Holophane Equipment

The Holophane Company, Limited, Toronto, have recently added several beautiful new semi-indirect bowls to their established lines of Calla and Veluria. Other designs are now in the works and will be brought out in ample time for the coming season. Like all the other products of this company, these semi-indirect units are scientifically constructed to produce maximum results in illumination. At the same time it has not been necessary to sacrifice the artistic effect, and these new units are not only graceful and pleasing in their general design but in the Veluria and Calla they embody a most beautiful finish, showing the rich effects of a carved alabaster and delicate tracings like a beautiful brocade. Invisible bands can also be furnished for these with swivel ball-socket joints and for such units as are drilled for hooks, special hooks are provided. This feature makes these units particularly desirable for fixture houses, permitting them to elaborate on fixtures. Bracket globes are also furnished to match these various units so as to complete the installation.

Semi-indirect units are reported to be meeting with an



unusual demand at the present time, and where they are scientifically designed provide not only an ample illumination but a high quality of lighting, eliminating objectionable glare to a very great extent and providing a system specially adapted to the relief of the eyes.

The Holophane Company are distributing an illustrated bulletin, showing their new line. They place their engineering department at the disposal of any prospective customer and gladly offer any assistance, or information, as to the proper installation of any of their equipment.

New Bell Factories

The Bell Electric Motor Company are constructing two modern fireproof steel and concrete factories about 200 feet long, to be used as an addition to their present factory. Special attention has been given to proper lighting and the installation of modern testing apparatus, by means of which single, two and three phase current is available for all commercial voltages.

Mr. W. H. Patton has been appointed supervisor of signals on G. T. R. Ontario lines, with headquarters in Toronto.

Current News and Notes

Aurora, Ont.

A by-law was submitted to the electors of the town of Aurora on June 30, approving an agreement made by the council with the Toronto & York Radial Railway Company for the supply of electric light and power.

Abbotsford, B.C.

Convinced of the splendid field which the town and district of Abbotsford, Fraser Valley, offers for the sale of electrical appliances, the B. C. Electric Railway Company intends to erect a show room and office for its light and power department at this point. Tenders for the construction of the building have been called for. The building will be a frame structure located just to the south of the company's tramway station. It will be 23 x 25 feet in size and one storey in height. The front portion of the building will be used for a show room for electric appliances, large plate glass windows being placed along its frontage which will be on a level with the station plaform. In the rear of the building are located two rooms, one of which will be used as a store room, and the other as an office for the company's light and power representative.

Amherst, N.S.

The Maritime Coal & Railway Company are said to have their plans in progress for a $5,000 transformer station.

Brockville, Ont.

Mr. J. W. Butler, of Poole's Resort, is installing a Fairbanks-Morse lighting installation with a capacity of 165 40-watt lamps. The installation also includes a storage battery equipment of sufficient capacity to carry thirty-six lamps for sixteen hours. A 4 h.p. kerosene engine will also be installed for power purposes. Mr. A. Stuart Allaster is architect for the work, which is being installed by Geo. Ross & Company, contractors, Brockville.

Brandon, Man.

A by-law recently passed authorizing the expenditure of $150,000 for additional railway extensions.

Calgary, Alta.

A by-law was recently passed authorizing additions to the power house equipment including gas-fired boilers and turbo-generators of 6600 h.p. capacity.

Cornwall, Ont.

The Canadian Cottons Company have recently installed a 650 kv.a., 2300 volt, three-phase, 60 cycle generator in their Cornwall factory, the generator is rope driven and can be operated by water or steam power; the electrical equipment is of the Swedish General Electric Company's make, supplied by Messrs. Kilmer, Pullen & Burnham, Toronto.

Dundas, Ont.

It has been proposed by the Water & Light Committee to illuminate all the approaches to the town. It has also been suggested that the town council co-operate with the surrounding municipality councils with a view to lighting the rural highways for some distance out.

Grenfell, Sask.

A by-law will be submitted on July 4, authorizing the expenditure of $15,000 on an electric lighting plant. It is probable the system will be installed by the British Canadian Engineering & Supply Company, of Winnipeg, which will consist of a producer gas equipment operating a small generator.

Galt, Ont.

The municipality of the town of Galt have installed a motor-driven stone crusher. The crusher is set on a permanent base and operated by a 30 h.p. motor.

Gananoque, Ont.

On July 7 a by-law will be submitted, authorizing the town to grant a bonus of $20,000 to the Gananoque and Arnprior Railway Company.

On July 7 a by-law will be submitted authorizing a contract between the Gananoque Electric Light & Water Supply Company and the town of Gananoque. The company agree to operate six arc lights and 250 60-watt tungsten lamps for street illumination, the former at $60 each and the latter at $720 each per annum. Commercial lighting is to be charged at the rate of 10c per kw.h. with 35 per cent. discount; or at 8c per kw.h. for the first 30 hours use of the installed capacity and 4c per kw.h. for all over this amount, with 10 per cent. discount. Residence lighting is to be 10c per kw.h. with 35 per cent. discount, or 4c per hundred square feet monthly plus 3c per kw.h. for all current consumed, with 10 per cent. discount.

Merritt, B.C.

Within the next year the municipality of the City of Merritt will install a second 125 kw. unit, 3-phase, 60 cycles, 2300 volts.

Montreal, Que.

Mr. William W. Ashland, superintendt of telegraphs for the Grand Trunk Railway, died suddenly, at his residence in Montreal, on June 19th. Mr. Ashland, who died from heart failure, following pneumonia, was connected for many years with the Grand Trunk telegraph department, joining the staff in 1899. He was born in Ohio, and was identified with railway work in Chicago and Detroit before coming to Canada.

New Toronto, Ont.

The council of the village of New Toronto will shortly submit a by-law authorizing the expenditure of $47,000 on electrical distribution equipment.

New Westminster, B.C.

The staff of the city electrician recently completed the work of doubling the voltage on the Sapperton and Queensborough circuits at New Westminster, both these circuits now carrying 2,000 volts.

Ottawa, Ont.

Bonus by-laws in connection with the St. Lawrence & Ottawa Electric Railway system have been carried in Winchester village and Osgoode township but defeated in Winchester township.

The Connaught Park race track near Aylmer, Que., which held its inaugural meet from June 14th to June 21st inclusive, drew big business for the Hull Electric Railway.

The company built a spur line from the main line to the park, a distance of about half a mile, and charged a fare of ten cents straight for a one-way trip to the park. About 50,000 travelled on the cars during the seven days the racing was held. Cars left the Chateau Laurier station every three minutes. The park is about five miles from Ottawa.

The Ottawa Collegiate Institute Board have decided to open classes for industrial training in the city on October 1st, this year. The programme of subjects to be taught include electricity, both practical and theoretical, practical English, workshop mathematics, freehand and geometrical drawing, building construction, architectural drawing, chemistry, physics and applied mechanics.

Peterborough, Ont.

The Hydro-electric Power Commission of Ontario have been asked to set a price on the distribution system of the Peterborough Light & Power Company so that the local power committee may be in a position to know what price they should offer for this equipment.

Port Arthur, Ont.

The municipality of the city of Port Arthur have awarded a contract for the complete electrical equipment for their new pumping station to the Siemens Company of Canada, Limited. The equipment will consist of three 275 h.p. self-starting, 3-phase, 60 cycle synchronous motors; an 8-panel switchboard; motor-generator exciters; transformers, cables, etc. The pumping equipment will be supplied by Messrs. Escher Wyss & Company.

The Siemens Company have also received repeat orders from the Hydro-electric Power Commission of Ontario for two further 22,000 volt feeder equipments, each of 2500 kv.a. capacity, for the Port Arthur sub-station. This company have carried out the complete electrical equipment for this station, which consists of seven 750 kv.a., 22,000 volt transformers; a 20-panel switchboard; lightning arresters; and two 750 h.p. motor-generators.

Russel, Man.

The village of Russel, Man., has recently installed a Rustom-Proctor, 75 h.p. suction gas engine, a Rustom-Proctor gas producer and a Westinghouse 2200 volt, 3-phase generator, with exciter and necessary switchboards, rheostats and transformers, etc. This equipment was all supplied by the British Canadian Engineering & Supply Company, Winnipeg. The building which will house this equipment will be of one storey, brick, 19 feet x 93 feet, including offices, etc. The village will install about 30 80-watt tungsten lamps for street lighting and about 80 5-amp. single phase meters to control about 1,000 lights. From present appearances it is expected that this plant will have to be doubled before the season is over.

Regina, Sask.

Tenders are called by the city commissioners up to July 12 for two vertical-shaft motor-driven centrifugal pumps.

A by-law was recently carried authorizing the operation of the street railway system on Sundays.

Renfrew, Ont.

The Renfrew Electric Manufacturing Company, Limited, has been incorporated with head office Renfrew, Ont.

Smiths Falls, Ont.

The Smiths Falls Electric Power Company have placed an order with the Canadian Westinghouse Company for a 275 kw. 3-phase, 60 cycle generator. This company will now change their entire system over from single to 3-phase.

Stellarton, N.S.

The Pictou County Electric Railway Company, Limited, are going to extend their line about three-quarters of a mile to the south end of New Glasgow, and will relay with heavier rails, the tracks on the main street. Mr. L. T. Flaherty is manager.

Sault Ste. Marie, Ont.

The franchise of the Tagona Water & Light Company expires in November, 1914, and it is said a movement is under way on the part of the town council to acquire this property and operate it as a municipal plant.

Stratford, Ont.

The franchise of the Stratford Railway Company has expired, and it is understood that the railway will not be built by the company unless a clause which requires them to buy power from the Hydro-electric Power Commission, is removed.

St. Thomas, Ont.

The city council recently decided to submit a by-law to the ratepayers in the near future authorizing an expenditure of $35,000 on double tracking Talbot street, from Stanley street to Alma street.

Toronto, Ont.

During the recent convention and general assembly in connection with the Presbyterian denomination held in Toronto, the generosity of the Toronto Railway Company in carrying all delegates free during the whole time of the convention was greatly appreciated by the delegates. A special communication was sent to general manager R. J. Fleming, stating that they had never experienced such uniform courtesy and consideration as that shown them by the street car conductors of Toronto.

Vancouver, B.C.

The North Coast Electric Company, Limited, has been incorporated with head office at Vancouver.

Thirty-five members of the Vancouver branch of the Canadian Society of Civil Engineers recently journeyed to Vancouver Island for the purpose of inspecting the steam auxiliary power plant of the Vancouver Island Power Company, situated at Brentwood Bay, a distance of 13 miles from Victoria. The visitors were shown over the plant by Mr. A. T. Goward, the Victoria manager of the B. C. Electric Railway Company, Mr. G. M. Tripp, local mechanical superintendent, and Mr. G. R. G. Conway, chief engineer of the company's system.

Welland, Ont.

A contract has been closed between the Ontario Hydro-electric Power Commission and the Union Carbide Company of Welland, under which the Commission agrees to supply the company up to a maximum of 16,000 h.p. The plant of the carbide company will cost in the neighborhood of $750,000, and, it is expected, will be in operation some time during the present year.

Yorkton, Sask.

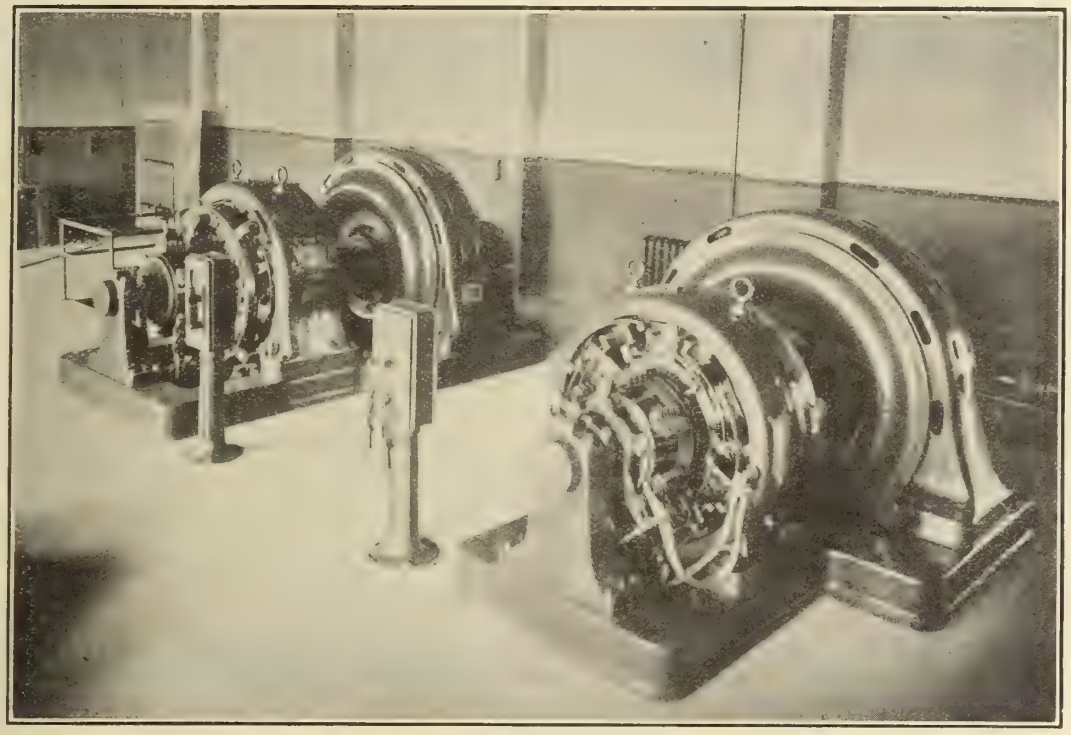
On June 20, a by-law was passed authorizing the expenditure of $140,000 for the purpose of extending the present generating plant and for further distribution equipment.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE

SIEMENS



One 400 K.W. and one 200 K.W. Siemens Self Starting Synchronous Motor Generators, supplied and installed for the City of Lethbridge

We have delivered or on order in Canada amongst others the following motor generators :—

1-800 K.W. Dominion Coal Co., N.S.
1-800 K.W. Canadian Collieries, B.C.
1-700 K.W. Canadian Collieries, B.C.
2-500 K.W. Winnipeg
2-500 K.W. Port Arthur
1-400 K.W. Lethbridge
1-250 K.W, Canada Sugar Refinery Co.
1-220 K.W. Dominion Coal Co., N.S.
1-200 K.W. Lethbridge
1-100 K.W. Northern Ontario Light & Power Co.
2- 70 K.W. Winnipeg Technical Schools
1- 70 K.W. Canada Motor Co., Winnipeg
1- 50 K.W. Medicine Hat

Siemens Company of Canada, Limited

HEAD OFFICE:
Transportation Building - MONTREAL

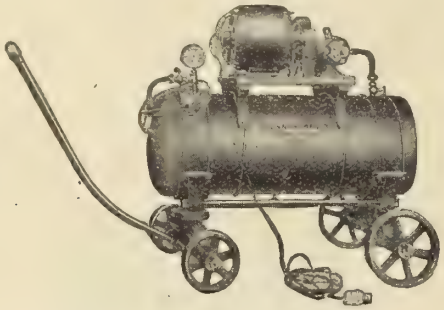
BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Portable Motor-Driven Automobile Tire Pump

The portable motor driven tire pump has been received with great favor by automobile owners and garages. It is brought to the car needing service so that its use eliminates the expensive, complicated and leaking air lines necessary with stationary installations. In private garages it furnishes complete relief from the back straining labor of hand pumping and enables the automobile owner to keep his tires at the pressure specified by tire manufacturers. In the outfit illustrated, the small motor driven air compressor is mounted upon the storage tank, the entire outfit being mounted on wheels. The compressor is driven by a one-half horse-power Westinghouse small motor which is operated from an electric light socket. The whole outfit is self-contained ready for operation the moment it is uncrated. It is provided with a pressure gauge, twelve feet of high pressure air hose, and an automatic tire connection, which shuts off the air when removed from the valve of the tire. The whole oufit has been made with great care and it is thoroughly air-tight. The pump is made by the Brunner Manufacturing Company, Utica, N.Y.



Portable tire pumping equipment.

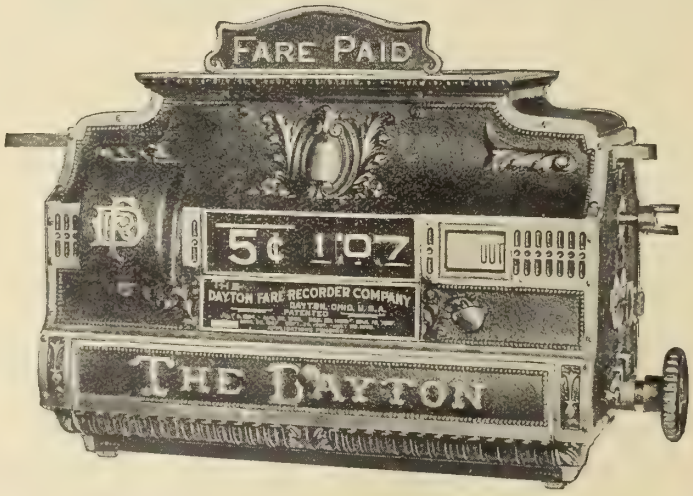
Transformer Station Will Be Enlarged

Owing to the addition to the No. 1 grain elevator of the Montreal Harbour Commissioners, the transformer station will have to be enlarged and re-arranged. The capacity of the elevator will be increased from one to two million bushels, and the addition to the station will be on a corresponding scale; when completed, the entire station will carry about 5,000 horse power, the current being supplied by the Montreal Light, Heat and Power Company. Most of the new electrical equipment has been contracted for. The Canadian Crocker-Wheeler Company will supply nine motors—4 of 150 h.p.; 4 of 40 h.p.; and one of 30 h.p.—a total of 790. These will be located on the various floors, and will be used in the conveying of grain to and from the bins, by means of belts. A contract for three 250 kw. transformers has been awarded to the Allis-Chalmers Company, while four 10 kw. lighting transformers will be supplied by the Canadian General Electric Company. The layout of the addition and the high tension work will be done by the staff of the Harbour Commissioners, under the supervision of Mr. T. E. Slater, the electrical engineer.

Mr. Arthur S. Herbert, formerly general manager of the Siemens Company of Canada, Limited, has resigned his position in Canada to accept the position of general manager of the branch offices of the Siemens Company in Australia. Mr. Herbert, who is now in England, will return to Canada early in July and will sail for Australia to assume his new position about the end of August. Mr. C. A. Ablett, who has been closely connected with the electrification of rolling mills in Europe during the past few years, and who recently made a brief investigation of the large steel works in Canada with regard to electric drive, will succeed Mr. Herbert.

The Dayton Fare Recorder

CASH REGISTER PUBLICITY



ADDING MACHINE ACCURACY

Can be used in any type of car and with any system of collection or for any denominations of fares.

A trip sheet is produced automatically as the fares are recorded, and when detached by the Conductor or the Auditor's representative, is tabulated, totalled and printed ready for use as a basis of settlement with the Receiver or Cashier.

Before you order new Fare Recording equipment or renew contracts for rented equipment, let us show you the superiority of "THE DAYTON."

The Dayton Fare Recorder Company

Factory: Dayton, Ohio

Sales Office: 30 Church St., New York



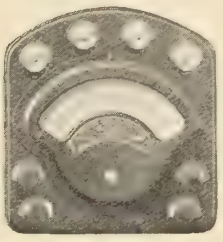
Model 280, Single Range Portable Voltmeter. (One-quarter size.)

WESTON

Miniature Precision Instruments for Direct Current

A new group of very small Indicating Instruments.

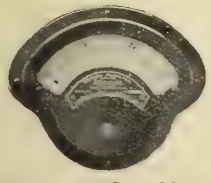
COMPACT—ACCURATE— DURABLE—BEAUTIFUL



Model 280, Triple Range Portable Volt-Ammeter. (One-quarter size.)

PORTABLE

Voltmeters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters are supplied in single, double and triple ranges.
The Volt-Ammeter comprising six instruments in one.
This group also includes BATTERY TESTERS.



Model 267, Switchboard Ammeter. (One-quarter size.)

SWITCHBOARD

Voltmeters Volt-Ammeters Ammeters Mil-Ammeters

This new line of instruments represents the latest development of the pivoted moving coil, permanent magnet type for low ranges.

The refinement of design and mechanical work in them has been carried to a degree which would appear to be almost impossible of accomplishment, if the results were not evident in the instruments themselves.

They embody characteristics which have made the well known Weston Standards famous throughout the world.

They are accurate, dead beat and extremely sensitive.



Model 268, Switchboard Volt Ammeter. Reads Amperes. Press Button for Volts. (One-quarter Size.)

They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.

They are substantially constructed and may be safely sent long distances through the mails and will withstand an extraordinary amount of vibration without injury.

They have the longest scale ever provided in instruments with equal length of pointer.

Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.

The portable instruments may be conveniently carried in the coat pocket.

The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate cost.

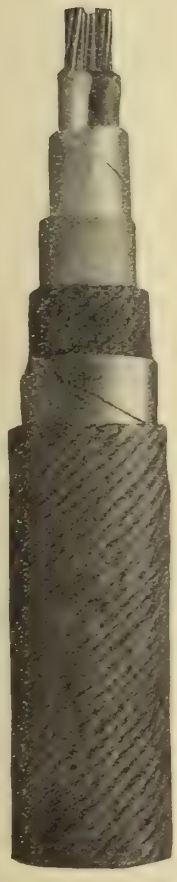
If you cannot obtain the instrument desired from your dealer, write us.

The several models and ranges offer a selection from over 300 different combinations, listed in Bulletin No. 8. Will be mailed upon request.

WESTON ELECTRICAL INSTRUMENT COMPANY,

Main Office and Works: NEWARK, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Block
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
St. Louis, 915 Olice Street.
Denver, 221 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 618 Union Trust Bldg.
Montreal, Winnipeg, Vancouver, Calgary — Northern Electric & Mfg. Co.
Toronto, 76 Bay Street.
Paris, 12 Rue St. Georges.
London, Audrey House, Ely Place, Holborn.
Berlin, Genest Str. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Buildings, Harrison Street.



Power Cables

Manufactured by

British Insulated & Helsby Cables, Limited

PAID-UP CAPITAL, $8,500,000.00

HEAD OFFICE—PRESCOT, ENG. Works at PRESCOT, HELSBY and LIVERPOOL

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

WRITE FOR ILLUSTRATED CATALOGUE

SOLE CANADIAN REPRESENTATIVES:

Canadian British Insulated Co.

LIMITED

MONTREAL, QUE.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

FOR SALE

125 Direct Current Jandus enclosed arc lamps for 110 Volt circuit, complete with opal inner globes and porcelain shades. These lamps have been used in our Department store, and will be sold at $6.00 each, Winnipeg.

We will sell the lot or any part at this price.

The T. EATON Co., LTD.,
Engineers' Department,
12-13 Winnipeg, Man.

For Sale

1500-light Dynamo, Exciter and Marble Switchboard, equipped with all attachments and instruments, all in first-class condition, for sale cheap; also one 13-inch LeFell Water Wheel, brass buckets, with wheel case, spur wheel and pinion. Box 819, Electrical News, Toronto, Ont.

CITY OF REGINA, SASK.

TENDERS

Sealed tenders will be received by the City Commissioners at Regina, Sask., until noon of July 12th, for the supply of: Two vertical shaft, motor driven, centrifugal pumps to operate against 22 foot head, capacity 12,500 gallons per minute each.

Tender to be accompanied by a marked cheque for 5 per cent. (five per cent.) of the amount of tender.

Further particulars may be obtained from E. W. Bull, Superintendent of Light & Power Department, Regina, Sask. 13

Car Ventilating Systems

The Cooke System of Mechanical Car Ventilation. Specifications and estimates furnished. Manufactured in Canada under Canadian Patent 128070. Vacuum Car Ventilating Co., 561 W. Monroe Street, Chicago, Ill. 11 t.f.

Nernst Lamp Scrap Parts

We purchase for cash Heater Tubes, Glower Ends, Burners and all kinds of Scrap Gold, Silver and Platinum. National Refining Co., Ltd., 81 Peter Street, Toronto. 13-14-16-18-20



For Rent—Cottages

If you want a real holiday, plan to spend your vacation this year in Muskoka where "the breezy call of incense breathing morn" will put new life in mind and body. Muskoka offers more real healthful enjoyment for less money than any other resort in the world.

Four cottages to rent $125 to $200 on Bohemia Island, less than a mile from Royal Muskoka Hotel and good Golf Links. Box 771,

Electrical News, Toronto Ont.

Situations Wanted

Plant Superintendent desires position in charge of a Western hydro-electric station in Ontario. References from past and present employers. Box 816, Electrical News, Toronto, Ont. 13

Experienced electrician wants position in large hydro-electric development; West preferred. Best references. Box 817, Electrical News, Toronto, Ont. 13

Telephone Engineer having ten years experience in engineering, Toll, Telegraph, Testing and Special Equipment, desires position with Telephone Company, Railroad Company or Consulting Engineer. Scotch. Age 32. Married. Self-educated. Box 164, Electrical News, Board of Trade, Montreal, Que. 12-13

Electrical Engineer, single, age 28, desires change. Seven years construction and maintenance work, Generators, Switchboards, Transmission lines, etc. Box 821, Electrical News, Toronto, Ont. 13-14

MOONLIGHT SCHEDULE FOR JULY, 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
July 1	8 00	July 2	3 50	7 50
2	8 00	3	3 50	7 50
3	8 00	4	3 50	7 50
4	8 00	5	3 50	7 50
5	8 00	6	3 50	7 50
6	8 00	7	3 50	7 50
7	8 00	8	3 50	7 50
8	8 00	9	3 50	7 50
9	8 00	10	3 50	7 50
10	8 00	11	4 00	8 00
11	10 20	12	4 00	5 40
12	10 50	13	4 00	5 10
13	11 30	14	4 00	4 30
15	0 10	15	4 00	3 50
16	1 10	16	4 00	2 50
17	No Light	17	No Light	
18	No Light	18	No Light	
19	7 50	19	10 10	2 20
20	7 50	20	10 30	2 40
21	7 50	21	10 50	3 00
22	7 50	22	11 10	3 20
23	7 50	23	11 30	3 40
24	7 50	24	11 50	4 00
25	7 50	26	0 10	4 20
26	7 50	27	0 30	4 40
27	7 50	28	1 10	5 20
28	7 50	29	1 50	6 00
29	7 40	30	2 40	7 00
30	7 40	31	3 40	8 00
31	7 40	Aug 1	4 10	8 30

Total Hours.....163 20



HOPE

Tapes and Webbings

for

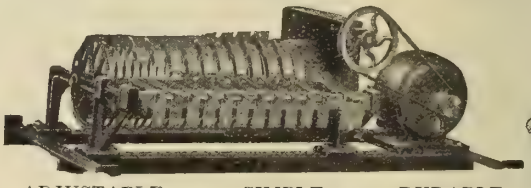
Electrical Work

Write for Samples and Prices

Hope Webbing Company

Providence, R.I.

RECO FLASHERS FOR ELECTRIC SIGNS AND DISPLAYS



Made in every style.



ADJUSTABLE -- SIMPLE -- DURABLE

COLORED LAMP HOODS

GET OUR LATEST BULLETINS

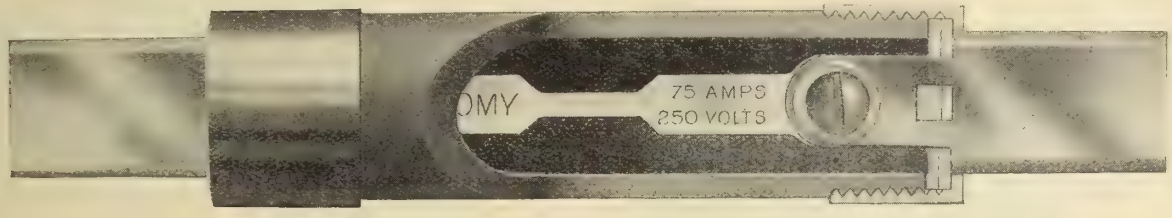
Reynolds Electric Flasher Mfg. Co.

Largest Manufacturers of Flashers in the World.
Also Manufacturers of Billboard Reflectors, Time Clocks, Transformers, Window Displays, etc.

No. 1123 Broadway, **New York.** No. 617-631 W. Jackson Blvd., **CHICAGO**

These Companies Have Decided that the Economy Renewable Fuse is Practical:

Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Anglo-Nfld. Development Co., Grand Falls, Nfld.
Canada Cement Co., Ltd., Montreal & Exshaw, Alta.
Canadian Niagara Power Co., Niagara Falls, Ont.
Can. Rubber Co. of Montreal, Ltd., Montreal, Que.
Gutta Percha & Rubber Mfg. Co., Ltd., Toronto.
Hydro-Electric Power Com. of Ont., Toronto, Ont.
Kaministiquia Power Co., Ltd., Ft. William, Ont.
Lake Superior Paper Co., Sault Ste. Marie, Ont.
The Maple Leaf Rubber Co., Port Dalhousie, Ont.
Merchants Rubber Company, Ltd., Berlin, Ont.
Spanish River Pulp & Paper Mills, Ltd., Toronto.
Superior Brick Company, Slate River, Ont.
Studebaker Corporation, Walkerville, Ont.



"Look for Gray Shell"

And for These Reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.

Second, because it is the only renewable fuse that is uniformly rated.

Third, because it is the only design so far produced that provides the desired electrical characteristics.

Fourth, because all capacities of renewal elements are readily available, making large stocks of fuses unnecessary.

Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.

Sixth, because they meet the performance specifications governing the use of such devices.

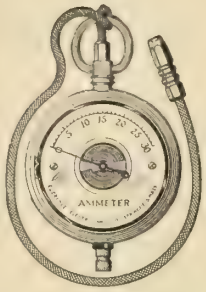
Special Announcement:

Two Economy Renewal Elements Are Now Furnished (without charge) with each Economy Fuse. Now YOU Figure What Fuse Is the Cheapest Not Only to Buy, but Also to MAINTAIN.

ECONOMY FUSE AND MFG. CO. OF CANADA, LTD.

Herald Bldg. - MONTREAL

Pocket Battery Ammeters



Voltmeters and Volt-ammeters, Small Switch-board Instruments, Lamp Testers.

Accurate, Durable.

Eldridge Electric Mfg. Co.

97 Post Office Square
SPRINGFIELD, MASS., U.S.A.

Yager's Soldering Fluxes

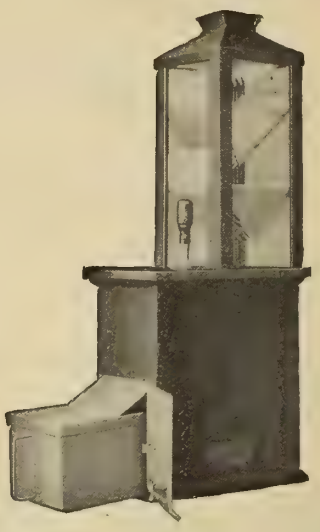
4 Forms—1 Result—The Perfect Joint

Efficiency is the word. Let us co-operate with you to increase the efficiency of your service. Use Yager's Fluxes in any of the four convenient forms — Salts—Stick—Paste — Fluid, to produce joints which will not fail you at the critical moment. No acid in any of them. They make the perfect electrical joint.

Write now for sample and discount.



ALEX. R. BENSON COMPANY
HUDSON, N. Y.



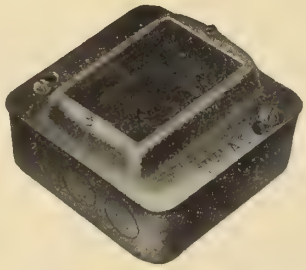
Cleveland Fare Box Co.

5310 St. Clair Ave., Cleveland, Ohio

"GOOD STUFF"

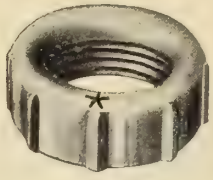
GET A SAMPLE

AND AT OUR EQUAL PRICES YOU WON'T WANT ANY OTHER MAKE.



"Steel City" Outlet Boxes

You cannot afford to use a box requiring more labor to install. Clean-Cut Knockouts. Sherardized or Enameled Finish. Packed in Heavy Paper Cartons and Wood Cases.



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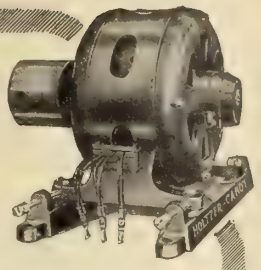
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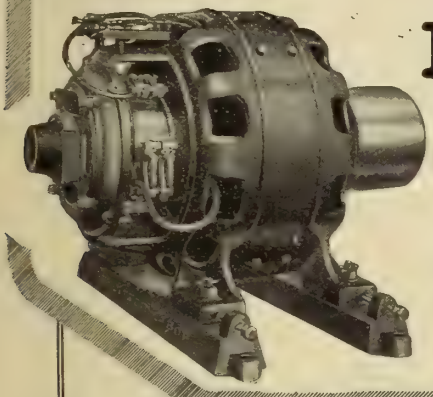
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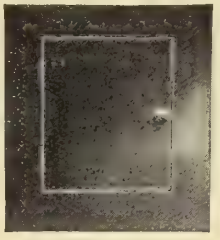
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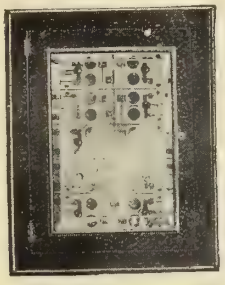
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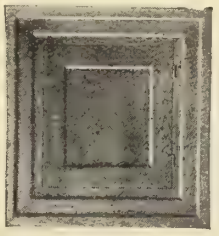
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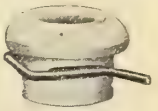
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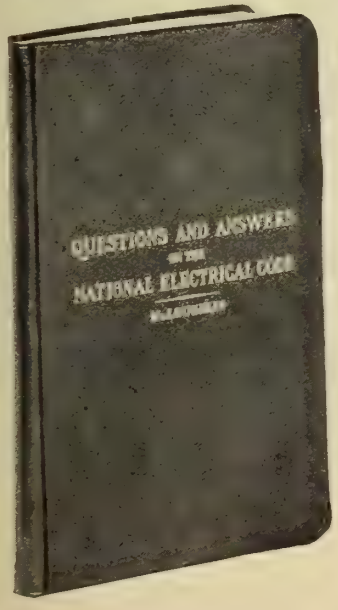
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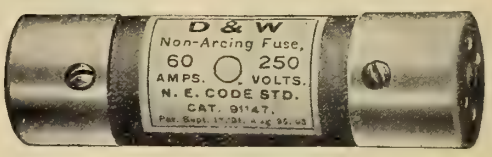
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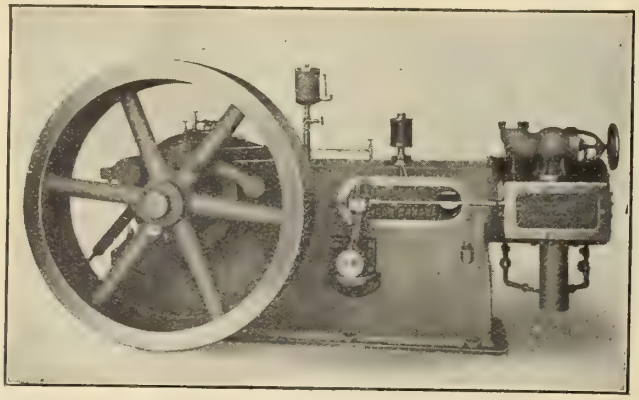
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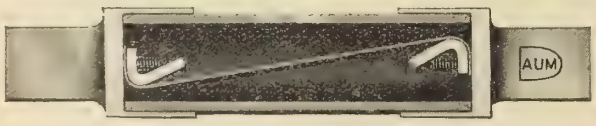


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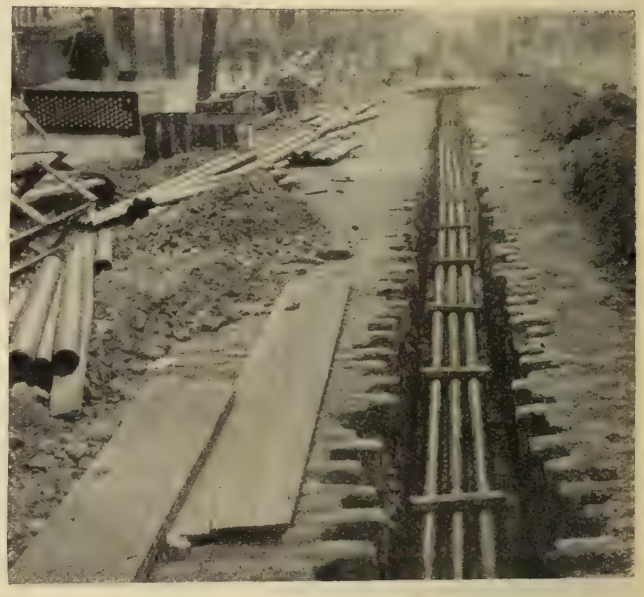
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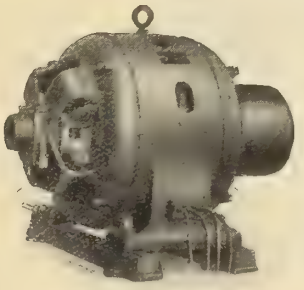
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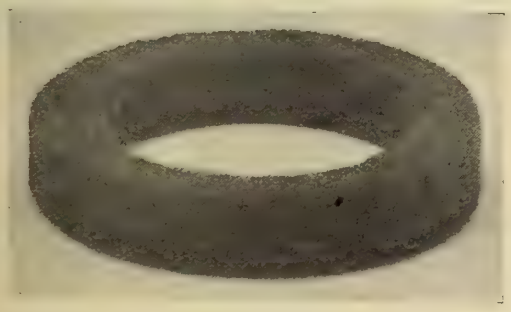
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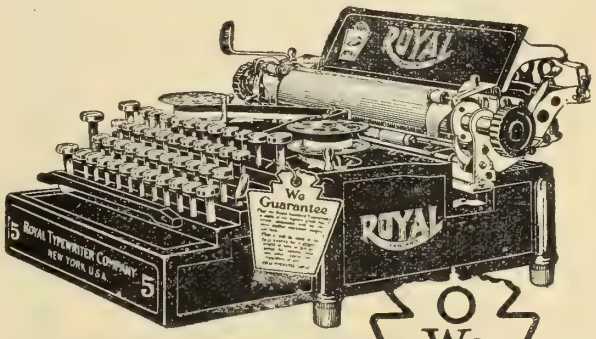
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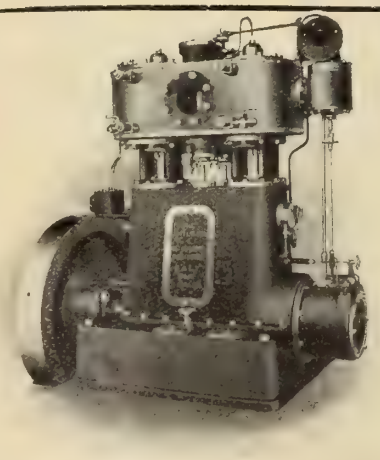
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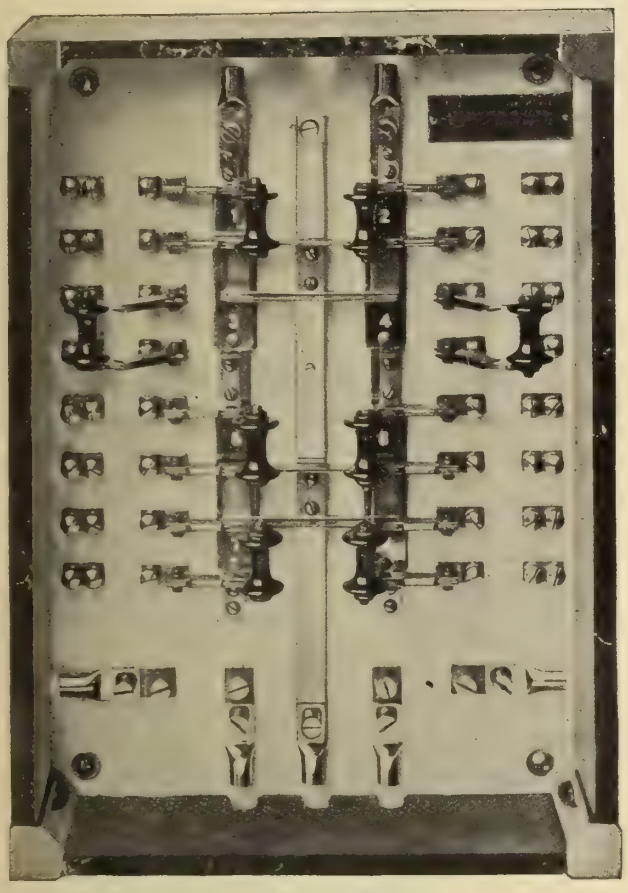
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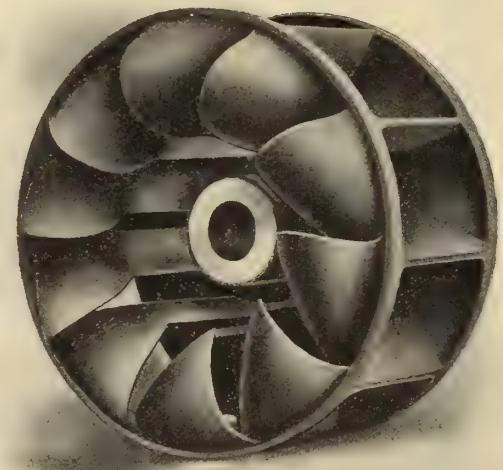
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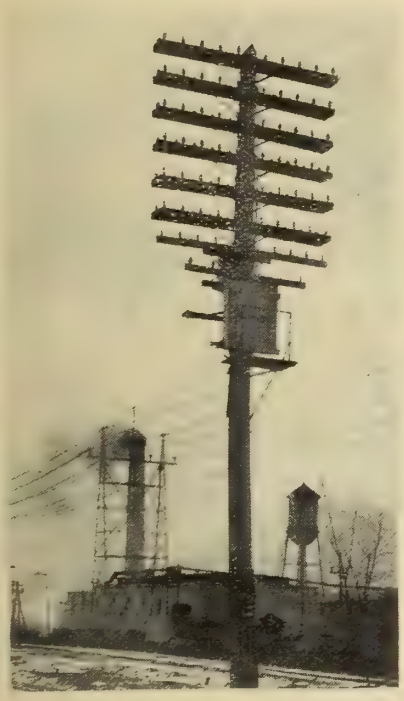
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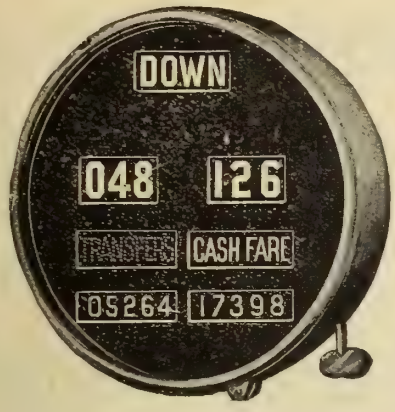
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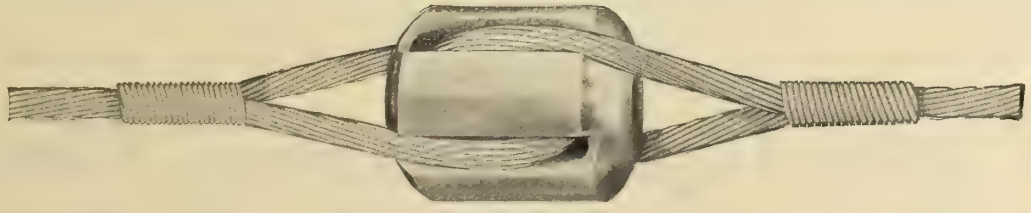
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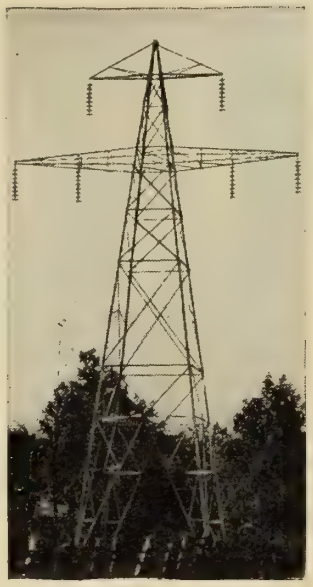
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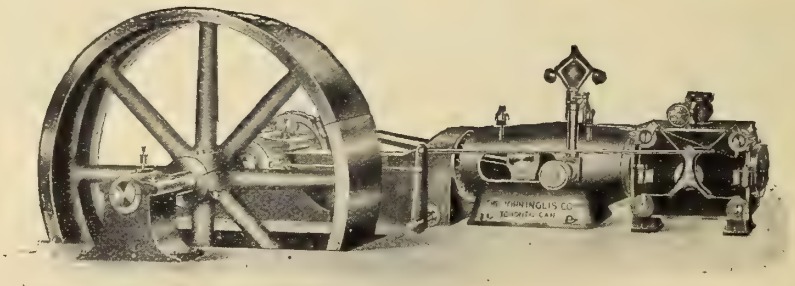
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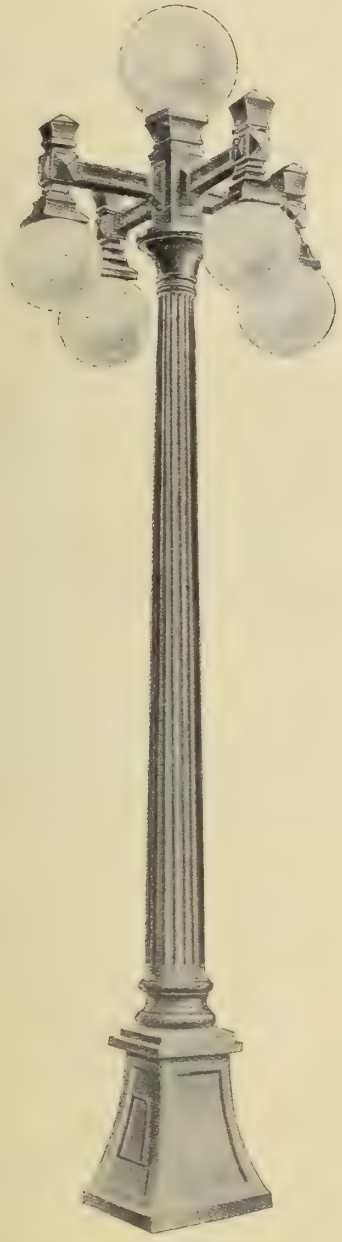
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Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Publishing Company. 332 pages. Price $1.50.

Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price $1.00.

Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price $1.00.

Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price $1.00.

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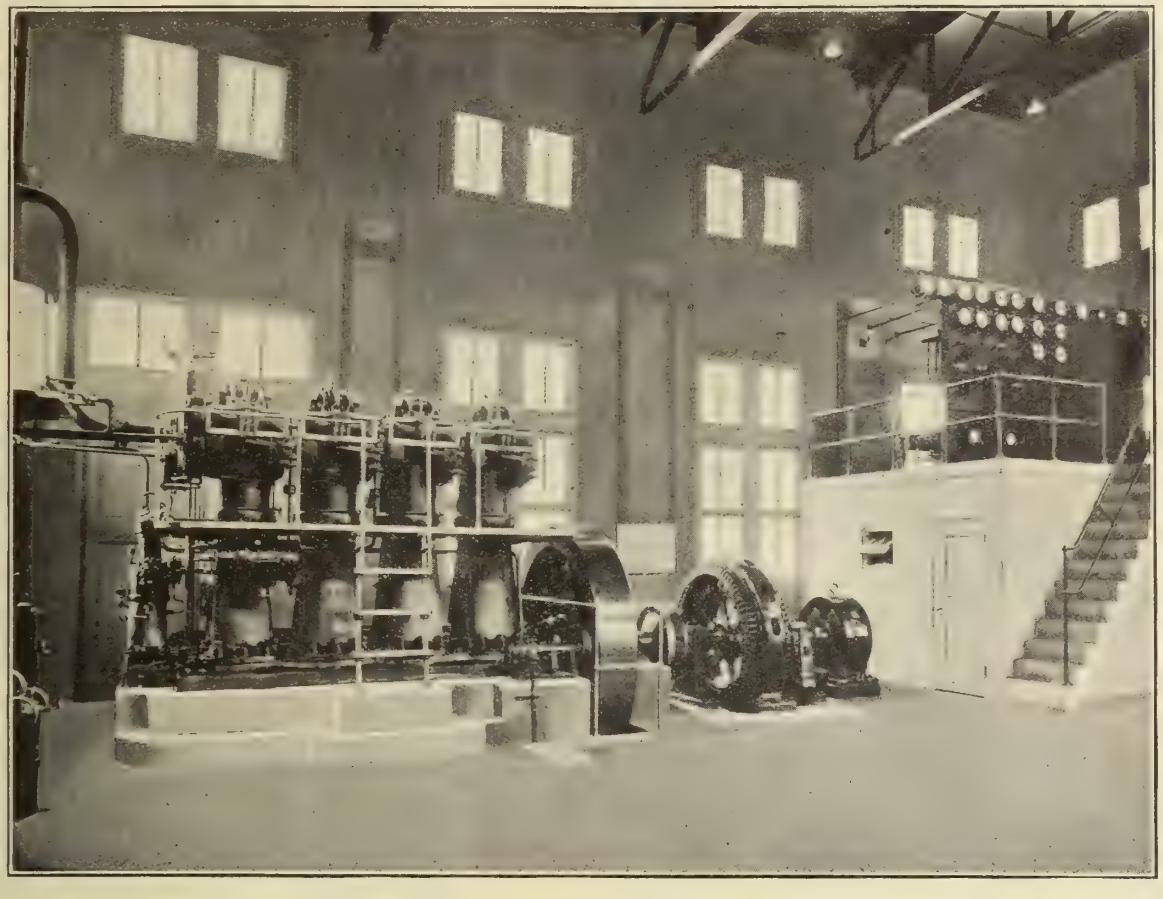
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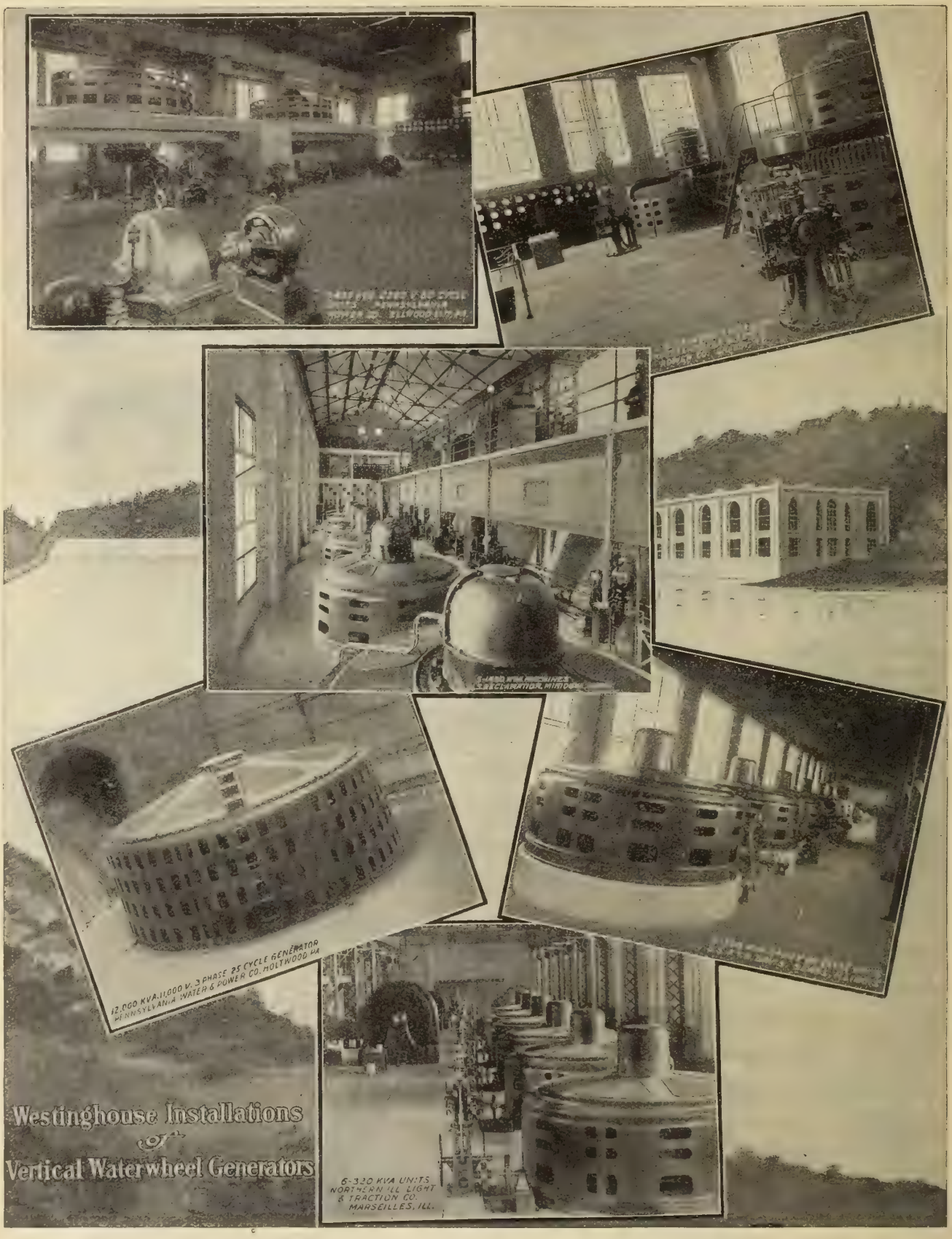
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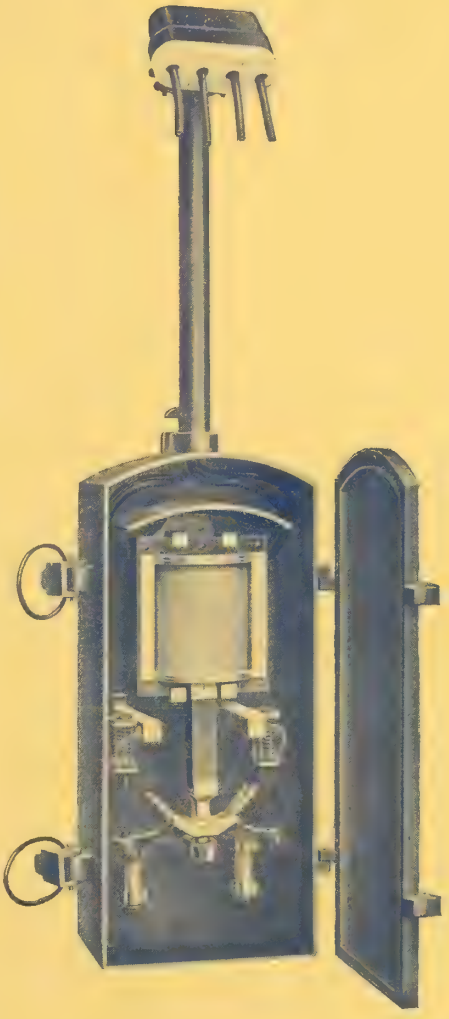
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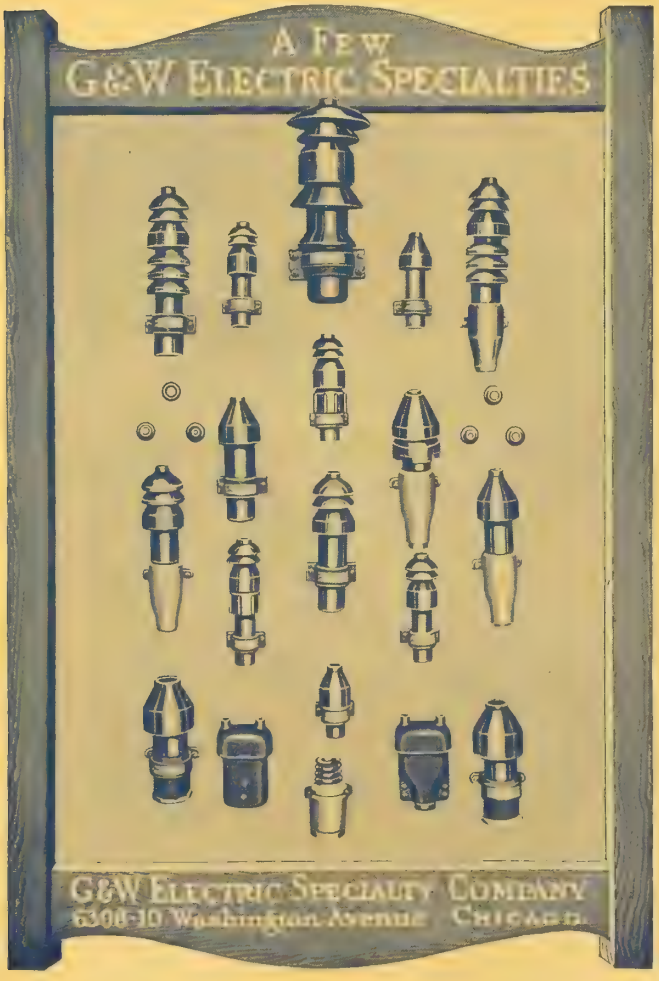
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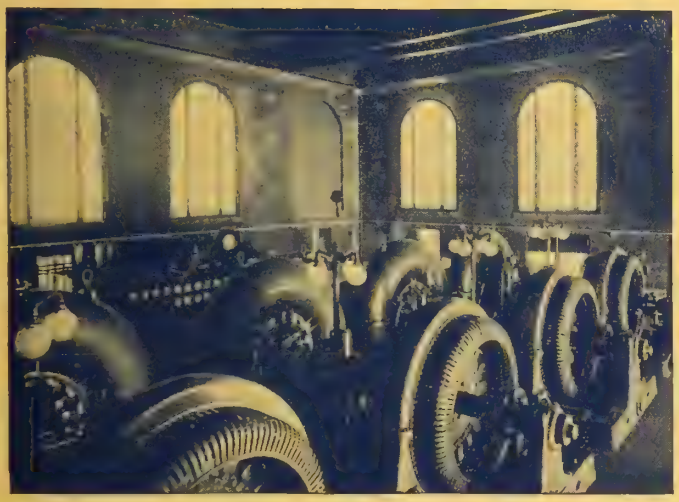




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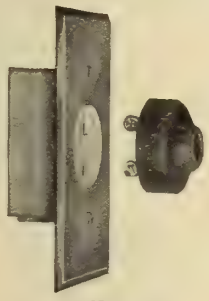
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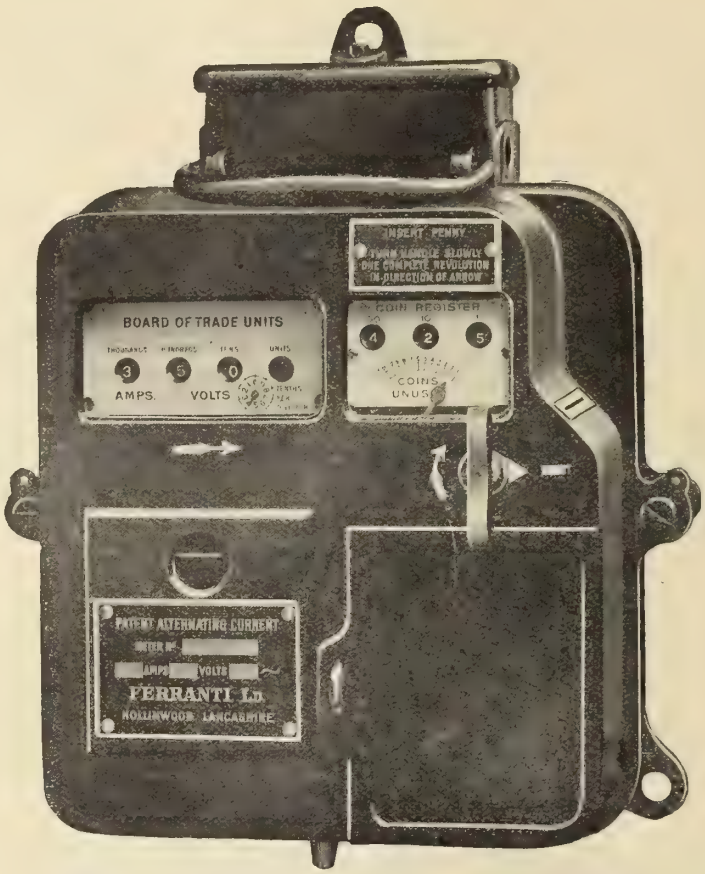
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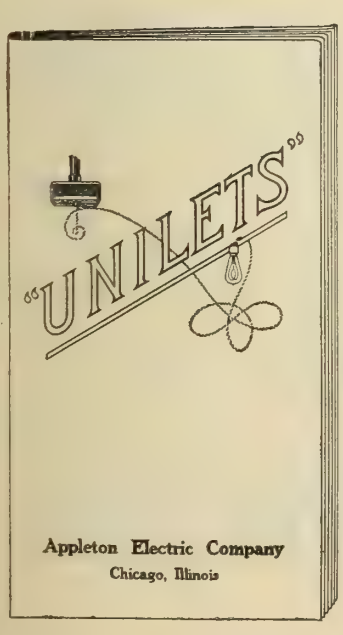
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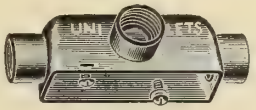




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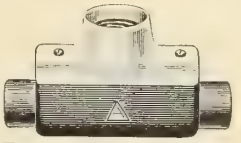

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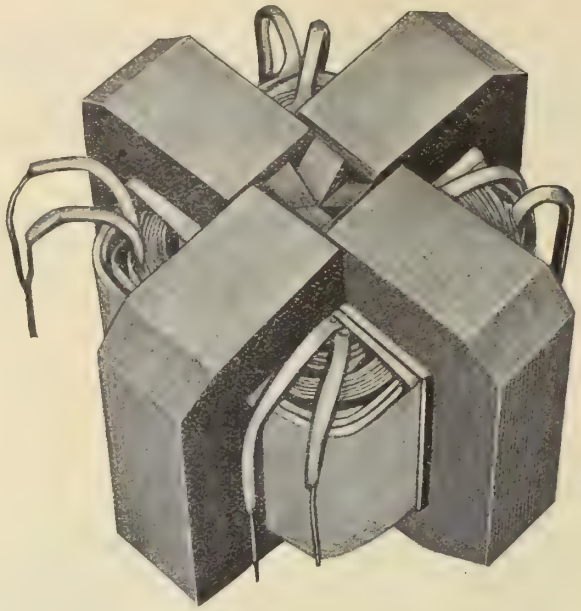
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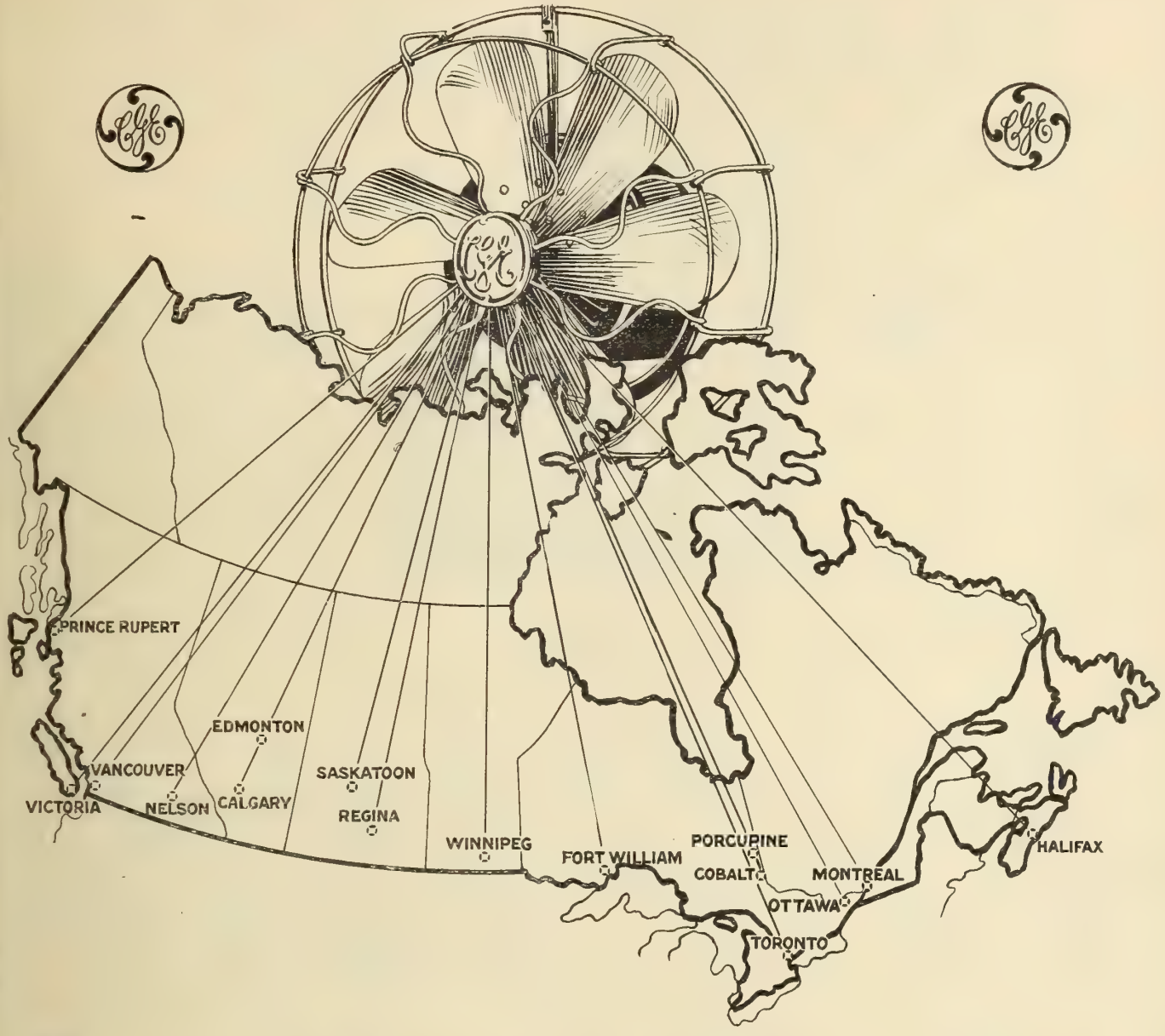
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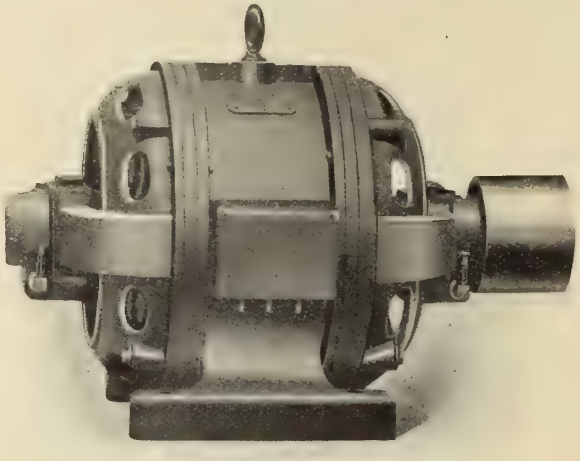
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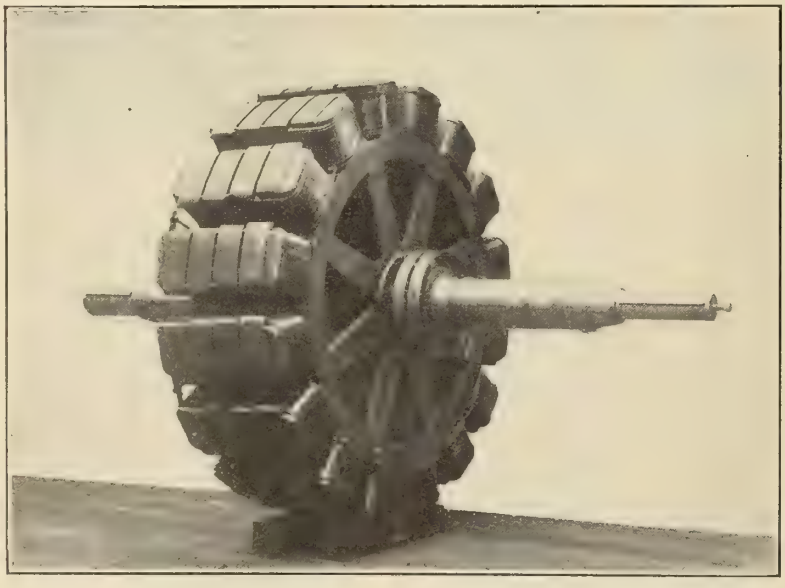
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Head Offices: NEW Birks Building, MONTREAL, QUE.



"Rotor of a 2500 KVA Generator, 375 RPM."

Descriptive Pamphlet of our Generators mailed upon request

Builders under the patents of the
Societe Alsacienne
Belfort, (FRANCE) Mulhouse, Grafenstaden (GERMANY

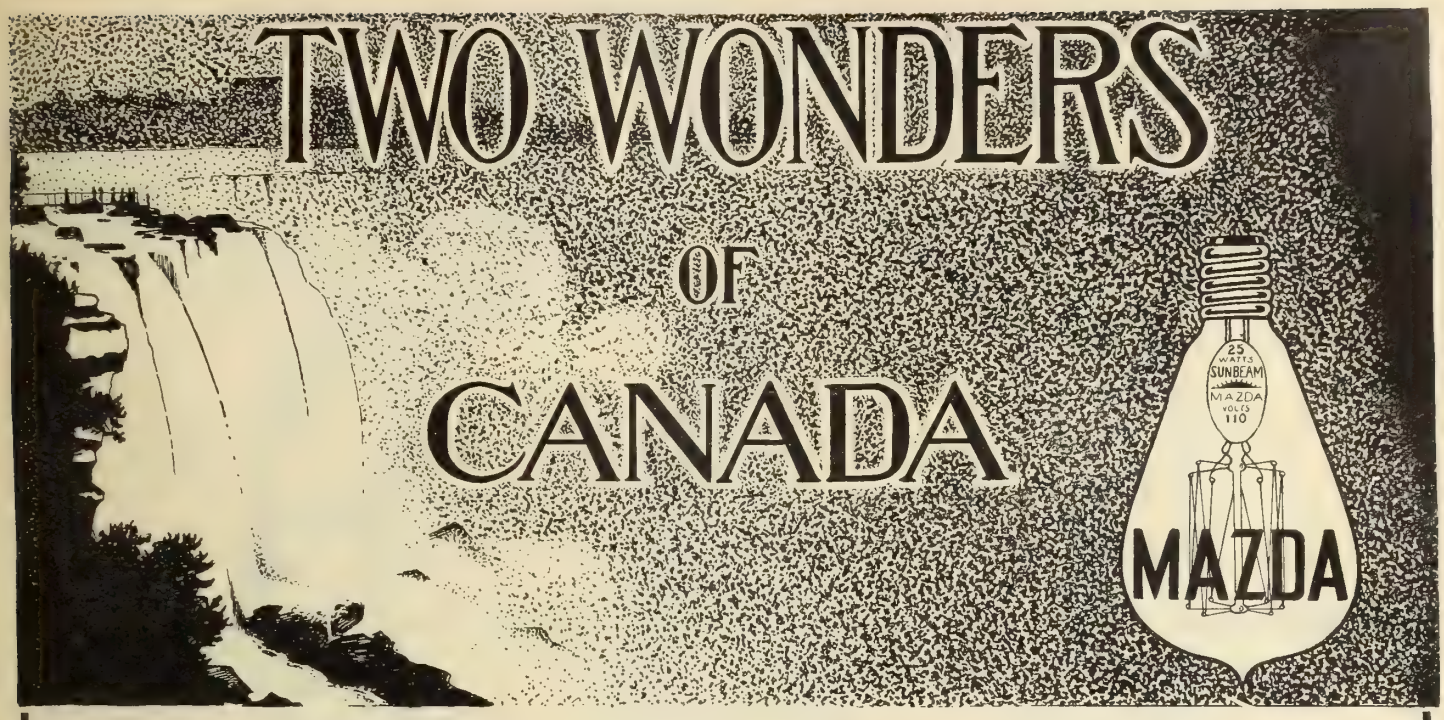
ESTABLISHED 1826

Power Plants, Rolling Mills, Mining and Hoisting Machinery

TIGLER'S

Patented Passenger and Freight

ELEVATORS



CLEAR as the falls and just as reliable and steady is the light of

SUNBEAM

Mazda Lamps

The demand for these lamps is a national one and every dealer should carry them.

Write us for prices and particulars.

Canadian Sunbeam Lamp Co., Limited

Main Office and Factory: TORONTO

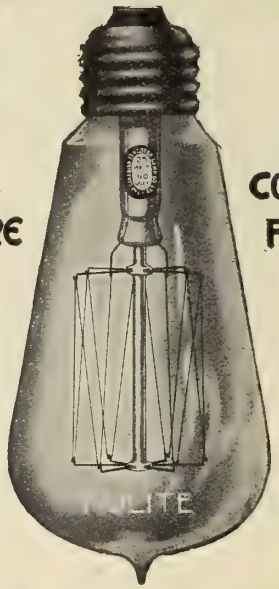
BRANCH WAREHOUSES:

MONTREAL **WINNIPEG** **CALGARY** **VANCOUVER**

"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE



CONTINUOUS FILAMENT

"The Lamp With a Record"

Enjoys the decision wherever a test is made.
Dealers supplied with their own advertising matter.
Deliveries guaranteed. Quality—the highest.
Economical, Durable and Efficient.

"NULITE"

A Canadian Product Manufactured by

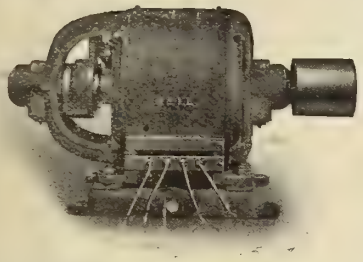
THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.

AGENCIES: T. McAvity & Son, St. John, N. B.; Farquhar Bros. Ltd., Halifax, N. S.; Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto, Ont.

"BELL" High Efficiency Single Phase Motors



Meet All Requirements

Large stock carried throughout the country for immediate shipment.

Attractive Prices consistent with QUALITY

Our bulletin No. 138 which fully describes them will be sent to all interested.

Bell Electric Motor Co., 30 Church Street, NEW YORK CITY
LICENSED. Factory, GARWOOD, N. J.
Canadian Representative:
The Masco Company, Ltd., 205 Yonge St., Toronto, Can.
Stock carried in Canada



Which of These Samples Represents Your Cable Joints?

"A" and "D" are filled with "Ozite" insulating compound; "B" and "C" with a competitive brand.

"A" and "B" were exposed to a temperature of 110 degrees Fahr. for two hours; "C" and "D" to a temperature of 80 to 85 degrees Fahr. for six weeks.

"Ozite" Insulating Compound

retained its shape in the sleeve and was soft like rubber; the other ran like molasses even at 85 degrees and was, at the same time, as brittle as glass.

Write our neare t office for information about "Ozite"

Standard Underground Cable Co., of Canada, Limited

Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all purposes, also Cable Accessories.

Something New
Darche Reminder Clock



By merely placing a plug at any desired time, clock will cause an alarm.
Operated by dry battery.
Ready for use.

AGENTS WANTED

Darche Mfg. Co. - Chicago
15 N. Jefferson St.

IRON HOUR SERVICE

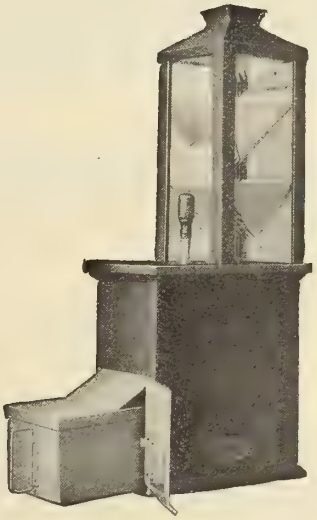
Do you know that 90 per cent. of the irons in laundries and manufacturing establishments (where 2000 to 3000 hours' work must be given every year) are Simplex?

Do you know that one year at such service equals the requirements of ten years of domestic service?

SIMPLEX ELECTRIC HEATING COMPANY
Mfrs. of everything for Electric Cooking and Heating
BELLEVILLE, ONT.
CHICAGO, 15 S. Desplaines St. **CAMBRIDGE, MASS.**
SAN FRANCISCO, 612 Howard St.

Have you received your copy of the new range booklet? It points the way to freedom from kitchen drudgery and will bring good business to you.

SIMPLEX EQUALITY

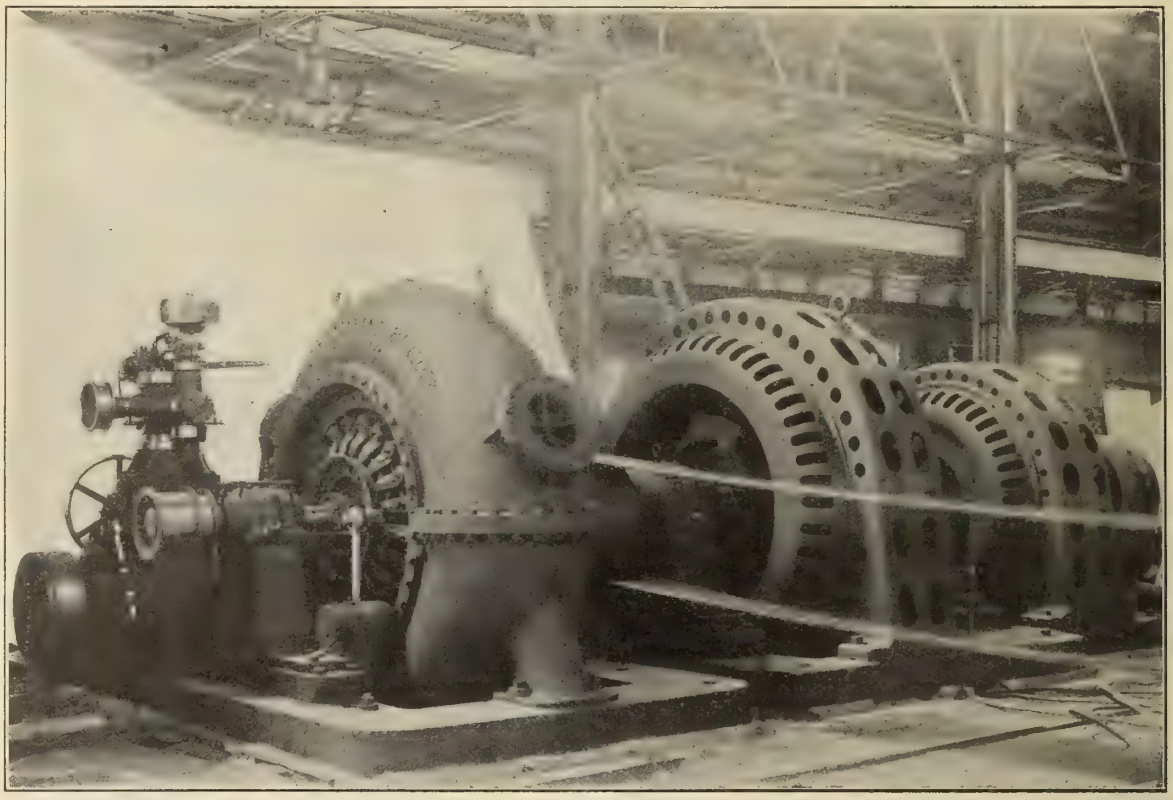


Cleveland Fare Box Co.

5310 St. Clair Ave., Cleveland, Ohio

HYDRAULIC TURBINES

SPECIALLY DESIGNED and BUILT FOR CONNECTION WITH ELECTRIC GENERATORS



Hydraulic Turbine Unit Under Test in Our Shops

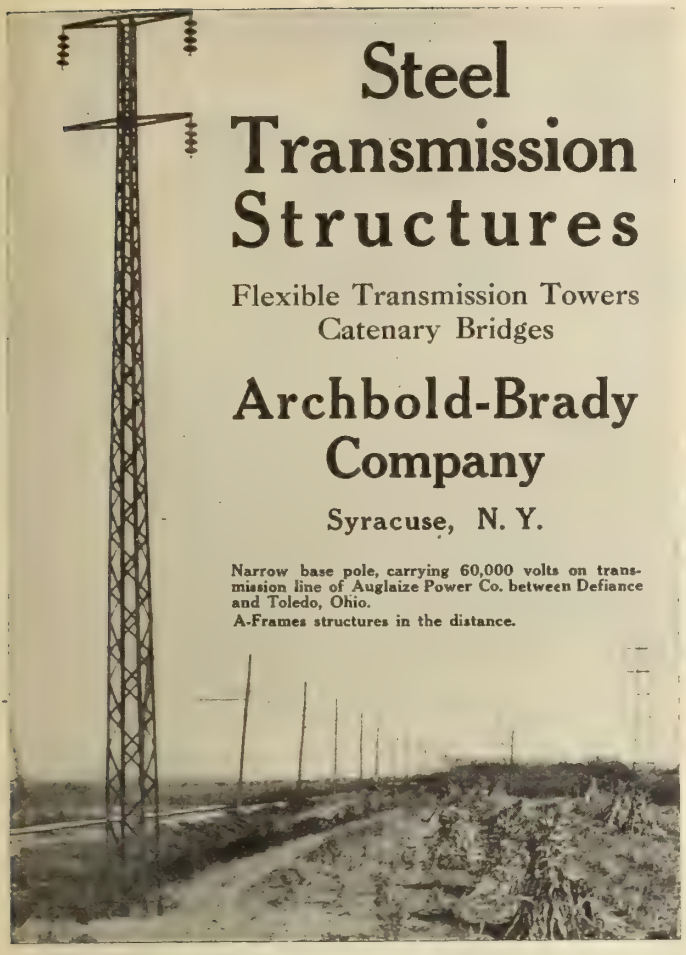
We design and build reaction turbines of the highest efficiency.

Our new oil pressure governor provides the safest and most sensitive regulation.

WORKS:—MONTREAL and TORONTO

CANADIAN ALLIS-CHALMERS,
LIMITED

Sales Offices: Halifax, Montreal, Ottawa, Toronto, Cobalt Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



Steel Transmission Structures

Flexible Transmission Towers
Catenary Bridges

Archbold-Brady Company

Syracuse, N. Y.

Narrow base pole, carrying 60,000 volts on transmission line of Auglaize Power Co. between Defiance and Toledo, Ohio.
A-Frames structures in the distance.



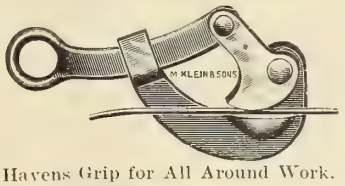
Parallel Screw Clamp.



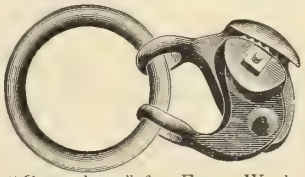
Chicago Grip for Insulated Wire.


Chicago Grip for Bare Wire.


Quick Samson Grip for Guy Wire.



Havens Grip for All Around Work.


"Comealong" for Fence Work.

WIRE GRIPS FOR EVERY JOB

If you require tools for line work turn to KLEIN.
Here we display a few wire grips covering a range from trolley to fence wire, and every type is doing service throughout the world.

Klein Tools Have Wired the Earth

and these grips were employed in the work.

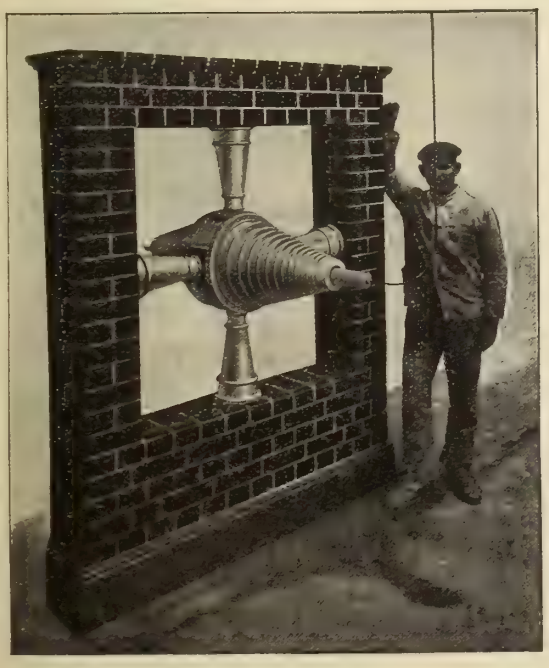
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are carried by the leading Electrical Supply and Hardware merchants.
Write us for a catalogue, then order from your most convenient source of supply.

Mathias Klein & Sons
Canal Station 59
Chicago, Ill.

Porzellanfabrik Hermsdorf

Sachsen-Altenburg, Germany



Wall Duct for the High Tension Transmission Station of the

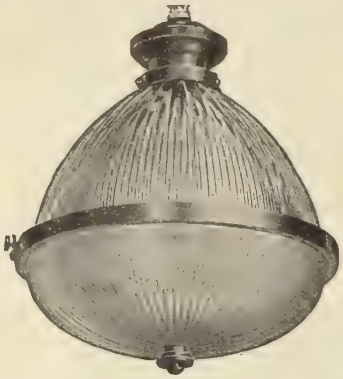
Hydro-Electric Power Commission of Ontario

110,000 Volts

Sole Agents for Canada

Watson Jack & Company

709 Power Building, MONTREAL



The Lighting Unit of *Quality*

The Holophane Realite

For all sizes of Mazda Lamps.
25 to 500 Watts.

Write for prices and details also for Holophane Illumination Data.

Endorsed by all the most up-to-date Central Stations in Canada as promoting more satisfied customers by affording the maximum illumination for current consumed.

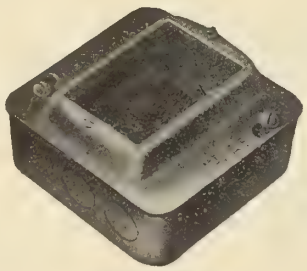
No other unit to equal it. **A Toronto product.**

The Holophane Co., Limited, Toronto, Can.

"GOOD STUFF"

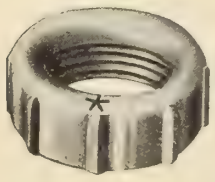
GET A SAMPLE

AND AT OUR EQUAL PRICES YOU WON'T WANT ANY OTHER MAKE.



"Steel City" Outlet Boxes

You cannot afford to use a box requiring more labor to install. Clean-Cut Knockouts. Sherardized or Enameled Finish. Packed in Heavy Paper Cartons and Wood Cases.



"Star" Bushings

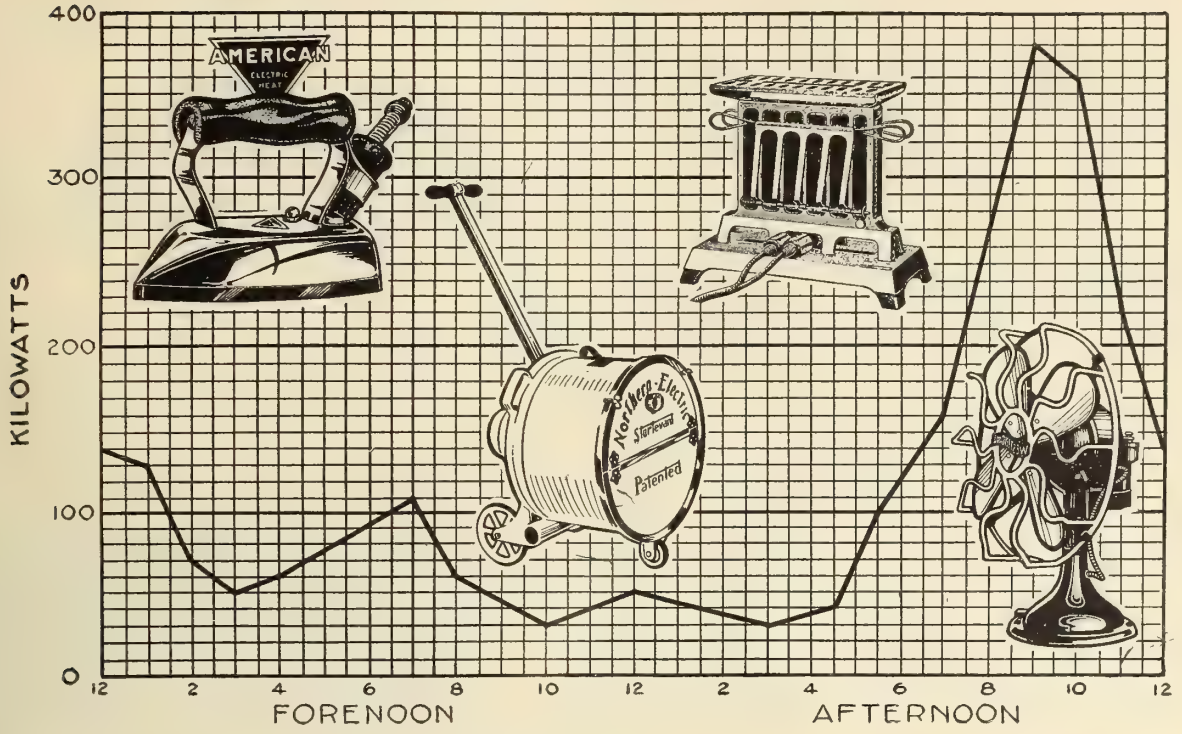
The kind the wireman likes. The name is famous and the bushings have been favorites since they were first manufactured.

Also "Fullman" Floor Outlets, "Universal" Insulator Supports, Fixture Stems, "Superior" Fish Wire, Conduit Benders, Beam Straps.

Write for Catalogs

STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

W. E. BUNDY, Canadian Sales Representative, 31 Melbourne Avenue, Toronto, Ontario, Canada.



Change Your Valleys Into Peaks

Those ten and three o'clock valleys have always been the Bugaboo of the average Manager of the small Central Station Plant.

Some time ago the big Central Station fellows discovered that they also had these valleys and immediately started changing them into peaks by pushing for all they were worth the sale of such valley boosters and household necessities as are here illustrated.

What the big men have done you can do and should do because it means clear profit to you.

Each article illustrated is the recognized standard of quality, both as to design, workmanship and finish, and at each of our Houses large stocks are available for immediate delivery.

You can start the boosting today by inaugurating a campaign on these current consuming devices.

Write our nearest house.

THE Northern Electric
AND MANUFACTURING CO. LIMITED

Manufacturer of Telephone and Fire Alarm Apparatus and Distributor of Electrical Supplies for every possible need.

Montreal Halifax Toronto Winnipeg
Regina Calgary Edmonton Vancouver

MICA

KENT BROTHERS

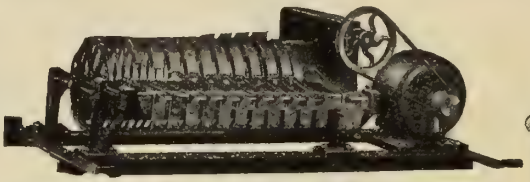
Kingston, Ont., Canada

Miners, Exporters and Dealers in Canadian Amber Mica.

Thumb Trimmed, Cut to Size, Splittings, Discs, Washers, Etc.

Write us for prices and let us figure on your requirements.

RECO FLASHERS FOR ELECTRIC SIGNS AND DISPLAYS



Made in every style.



ADJUSTABLE -- SIMPLE -- DURABLE

COLORED LAMP HOODS

GET OUR LATEST BULLETINS

Reynolds Electric Flasher Mfg. Co.

Largest Manufacturers of Flashers in the World.
Also Manufacturers of Billboard Reflectors, Time Clocks, Transformers, Window Displays, etc.

No. 1123 Broadway, **New York.** No. 617-631 W. Jackson Blvd., **CHICAGO**

The CANADIAN BRITISH ENGINEERING COMPANY

LIMITED

WINNIPEG BRANCH - 324 Smith St., Winnipeg

Wholesale Electrical Supplies

A large and varied stock carried at our Winnipeg warehouse including

- Wires and Cables
- Conduits
- Conduit Fittings and Boxes
- Switches
- Fuses
- Cutouts
- Sockets
- Receptacles, etc.
- Mazda and Carbon Lamps
- Street Light Fittings
- Telephones
- Bells and Fire Alarms
- Dry Cells
- Secondary Batteries
- Heating and Cooking Devices
- Electric Motors
- Electric Meters

OUR ENDEAVOR

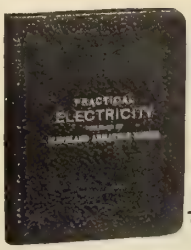
is to ship standard supplies the day order is received

ELECTRICAL MACHINERY

AND REPAIRS

Armatures Complete
Armatures Rewound
Armature Coils
Armature Shafts
Field Coils

Commutators New, Refilled or Assembled

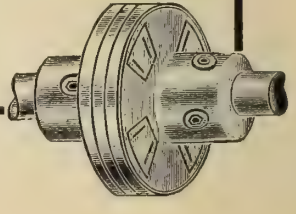


Every electrician should have a copy of this book. Price - $2.00 delivered

CLEVELAND ARMATURE WORKS, Cleveland, Ohio

This Coupling INSULATES

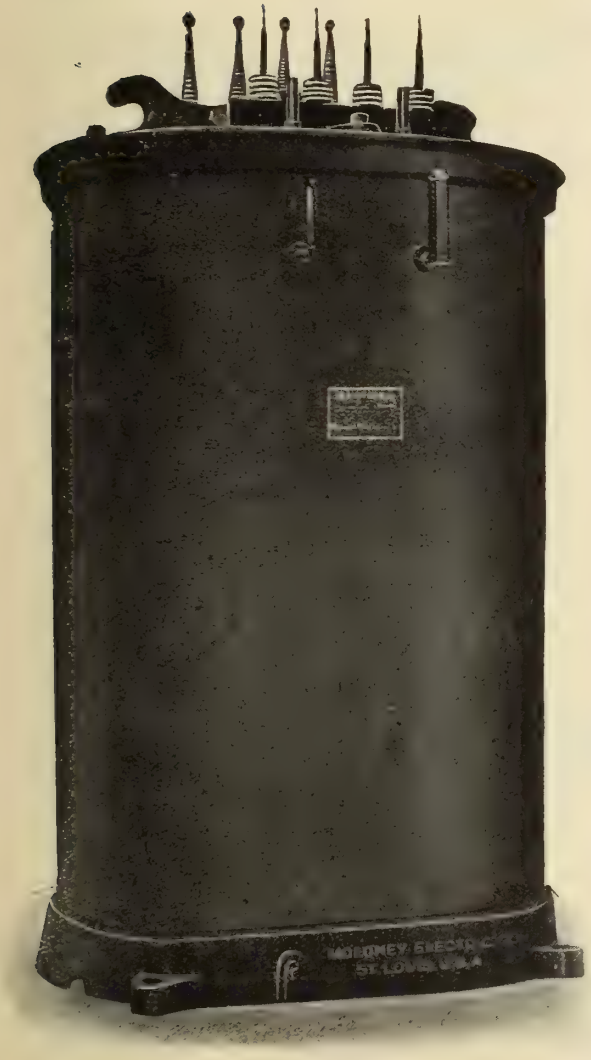
—is highly powerful, absolutely positive and silent. Adapts itself to drives in which shafts are not well aligned, and runs either way. Practically indestructible, and needs no repairs. Always specify the **Grundy Flexible Coupling.** *Write for particulars and prices NOW.*



Canadian Bond Hanger & Coupling Co., Limited
Alexandria, Ont.

The Best In 1897

Moloney Efficiency



A PERFECT transformer should take your current at one voltage and deliver it (100%) another voltage. No transformer made will do this as the core and copper losses consume some energy. The special core type construction of Moloney High Efficiency transformers and the non-ageing Silicon Alloy Steel used in their manufacture reduces core loss to a minimum. Carrying capacity of the copper reduces copper loss.

Moloney Transformers will save 20% of the cost of other good transformers, and in five years the cost of a new transformer.

The Best In 1913

Our Catalogue contains much valuable information

Canadian Moloney Electric Company, Limited

WINDSOR, ONTARIO

Complete Stocks at **Windsor, Winnipeg, Vancouver**

REASONS WHY

you should buy Kellogg telephone equipment.

Our factory is conveniently located for handling shipments promptly.

Equipments in operation in all parts of the world—giving good service under a variety of conditions.

We guarantee all telephones and switchboards for five years to be free from inherent defects.

Your requirements are given the most careful attention and equipment is supplied of the proper design to fit your particular needs.

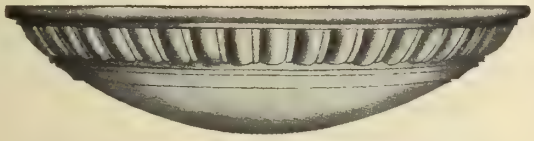
Take "Kellogg" into consideration before you buy—write for prices and bulletins, mentioning this magazine.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

MAIN OFFICE AND FACTORY: CHICAGO

CANADIAN SALES OFFICES:
DEERING ELECTRIC LIMITED, REGINA, SASK.
HOUSTON & COMPANY, LIMITED, WINNIPEG, MAN.
B. C. HOLST & COMPANY, VANCOUVER, B.C.

MOONSTONE GLASS



No. 6020—14 inch Moonstone



No. 6022—15 1/2 inch Moonstone



No. 6030—20 inch Moonstone

If you want the most up-to-date, efficient and artistic illumination use

Moonstone Semi-Indirect Bowls.

The Jefferson Glass Company Limited

MADE IN CANADA

TORONTO CANADA

"SHAWMUT"
Electrical Material

Enclosed Fuses
Fuse Blocks
Porcelain Cutouts
Fuse Wire and Ribbon
Fuse Links

Ground Connection Clamps
Nipples and Couplings
Stage Pockets and Plugs
Metal Cable Clips, Etc.

Manufactured by

CHASE-SHAWMUT CO.
Newburyport, Massachusetts

FRANK G. SCOFIELD
REPRESENTATIVE FOR ONTARIO
702 LUMSDEN BLDG. - TORONTO, ONT

Plug the Plug Game Hard

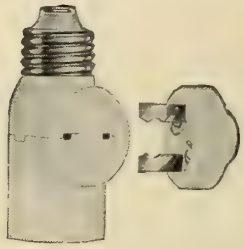


Put real man-power back of your purpose. Realize this. No electric fan, toaster, percolator, vacuum cleaner or other portable device can give full measure of service if hampered by a faulty attachment plug.

Hubbell Interchangeable Plugs

stand head and shoulders above all others in points of utility, convenience, safety, endurance.

The more devices you sell fitted with Hubbell Plugs the easier it will be to sell Hubbell Flush Receptacles for permanent installation in all classes of buildings. Both are money winners for you. Write to day and learn what we'll do to boost your sales.



R. E. T. PRINGLE
95 King St. E.
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We specialize as follows:

Street Railway Supplies — Pole Line Material
Hot Point Heating Apparatus
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Arc Lamps and Carbons
General Supplies of all kinds
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Telephones and Transformers

Let us quote you prices. It will save you money.

Dawson & Company, Limited, Winnipeg Montreal





P & S porcelain, weather-proof conduit box receptacles are made in many styles. We illustrate two for four inch boxes, one with shade holder groove and one without.

The wires are six inches long and are new code rubber covered.

The porcelain is the celebrated P & S quality with smooth uniform glaze.

Ask your jobber to show you samples.

Pass & Seymour, Inc.

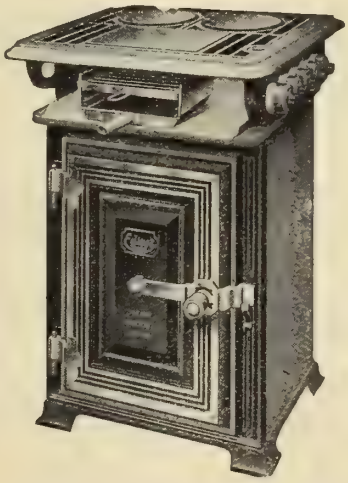
Main Office and Works:
Solvay, New York, U. S. A.
San Francisco, Rialto Building

Sold By All Jobbers

Carried in Stock by:

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"ECLIPSE" COOKERS GIVE SUCCESSFUL RESULTS



"ECLIPSE" DOMESTIC COOKER

THE LEADING BRITISH-BUILT COOKERS— ACKNOWLEDGED BY ALL USERS

Will do everything a gas cooker will do, except smell and fume. Luminous Radiant Heat in Oven and Grill.

Can be procured in Canada from the Supply Authorities, Electrical Dealers, or from our Montreal office as under.

The Electric & Ordnance Accessories Company Limited

Head Office for Canada:—LEWIS BLDG., MONTREAL
Mr. J. P. I. Thomas (Representative)

Works:—Aston, Birmingham ENGLAND

Profit Makers For The Summer Months

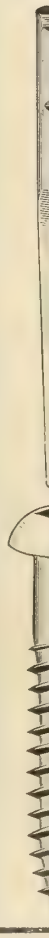
Fansteel Irons
Fansteel Disc Heaters
Hughes Ranges
Universal Toasters
Universal Irons
Universal Coffee Percolators
Radiant Toasters

We carry a full line of specialties

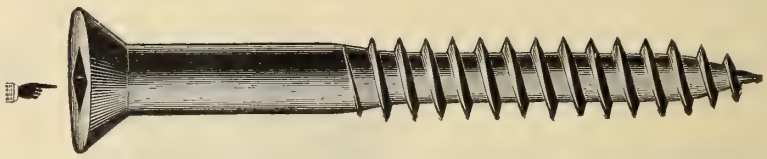
Mainer Electric Co., Limited

Winnipeg, Man. Edmonton, Alta.

The largest Electrical Supply House in the West



SEE THAT SQUARE HOLE



PAT. FEB. 2, 1909



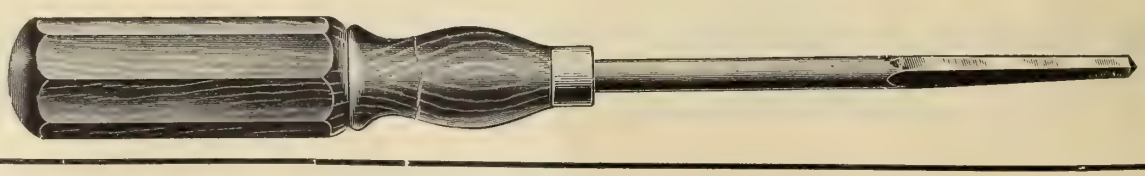
SOCKET HEAD Wood Screws

The advantages of this wood screw are many. The screw may be placed on the driver and driven at arms length, with one hand. It is impossible for the driver to slip out of the socket.
Drivers are made in a variety of suitable styles.
For electrical wiring and fixture work, etc. this type of screw is unrivalled.

Samples, prices and catalogue on request.

P. L. Robertson Manufacturing Co., Ltd.

Milton — Ontario



Packard

SUPERIOR QUALITY

Packard

Whenever you see this trade mark

THINK OF

LAMPS, METERS and TRANSFORMERS

It stands for the highest attainment both in design and mechanical construction. It is an absolute guarantee of quality. It is a positive insurance against breakdown and failures.

Large stock, from which we make prompt shipments, carried at St. Catharines and Winnipeg; St. John Railway Co., St. John, N.B; General Supplies, Limited, Calgary, Alta.

The Packard Electric Company, Limited

Factory: ST. CATHARINES

General Sales Office;
901-902 Traders Bank Building,
TORONTO

N. W. Office and Warehouse
WINNIPEG

Packard

HIGH-GRADE WORKMANSHIP

Packard

Monarch Electric Co., Ltd.

St. Lambert, P. Q.

Phone Main 3988 Montreal Exchange **District Montreal**

A few of the Monarch Canadian Made Specialties manufactured in this, our own building, are:

Sockets—Rosettes—Attachment Plugs
Lamp Guards—Knife Switches



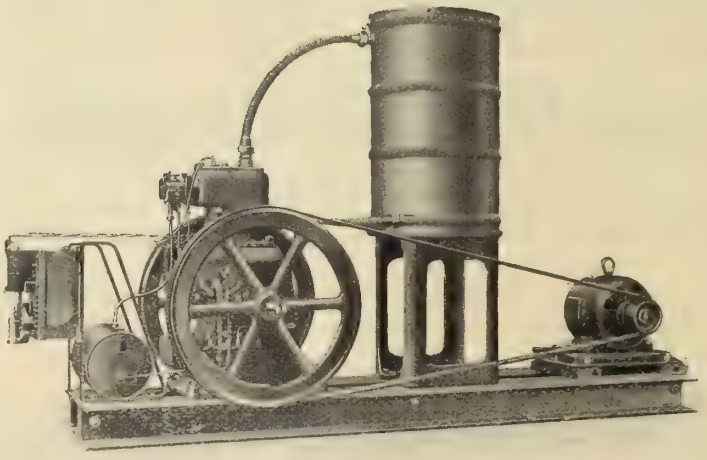
Oil Circuit Breakers
Switchboard Accessories
Switchboards
Transformers for Instruments

LISTER-BRUSTON

AUTOMATIC ELECTRIC LIGHTING and PUMPING INSTALLATION

Suitable for Lighting

Small Towns
Country Houses
Bungalows
Hotels
Clubs
Churches
Schools
Etc.



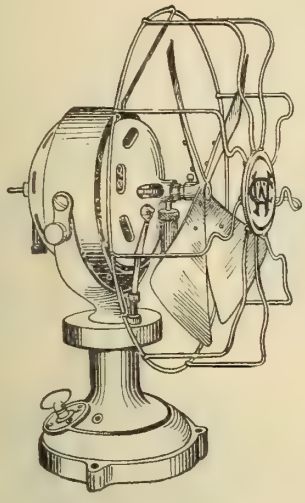
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SELF-STARTING
SELF-STOPPING

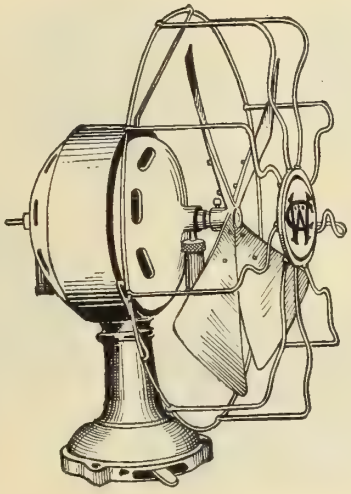
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R. A. LISTER & COMPANY, LIMITED

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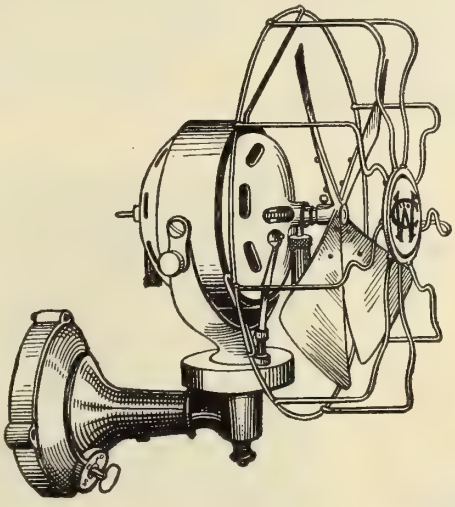


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The time is here and if you have not already laid in your supply, do not delay. Send in your order to-day. We have a good supply from which we can make prompt shipment.

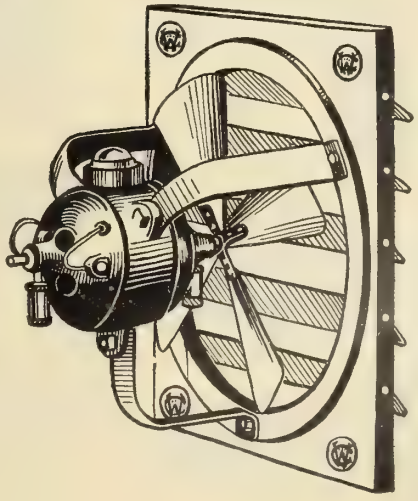


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C. & W. Fans produce a steady invigorating breeze and you can depend upon them giving your customers complete satisfaction. They are reliable and do not wear out in a season.

We have a complete stock in all sizes, in direct or alternating current motors, consisting of oscillating and stationary desk, wall and ceiling fans. The designs are neat and attractive, the workmanship perfect. They are noiseless in operation and superior in every way to any thing heretofore shown.

C. & W. Fans will be more popular than ever this season. If you have not already ordered, do so to-day.



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Toronto, Ontario

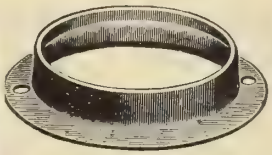
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Made in Canada

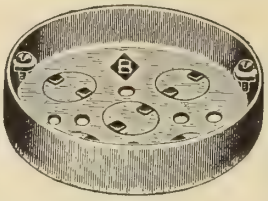
Iron Conduit—Conduit Boxes—Pipe Fittings and Accessories



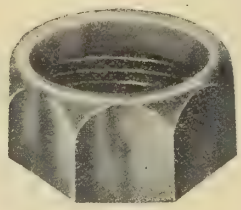
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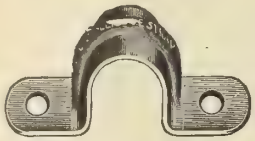
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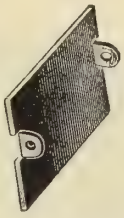


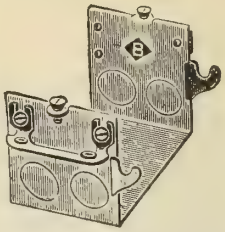
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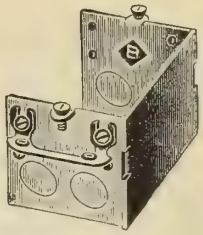










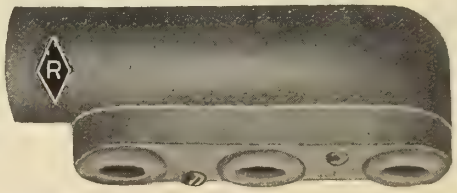


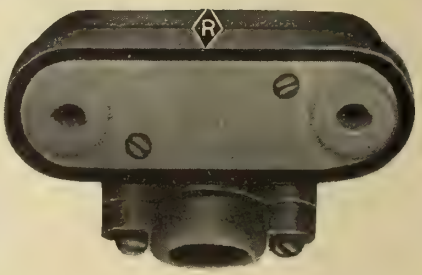
Type C 3″ deep—C C S-2″ deep
side comes off and does away with carrying two gangs

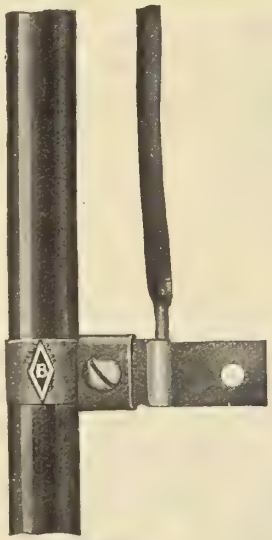


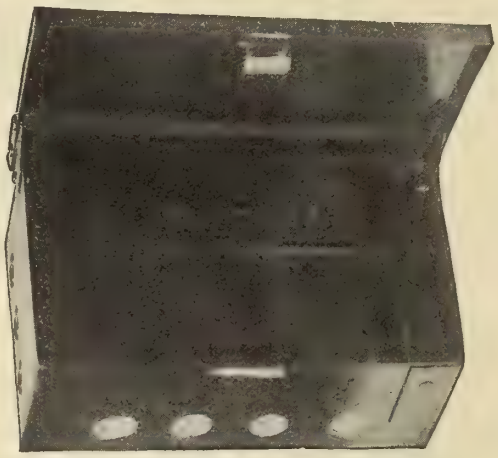
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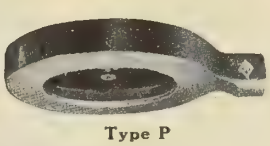


Steel Cutout Boxes









Type P



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Electrical Fittings Co., Limited

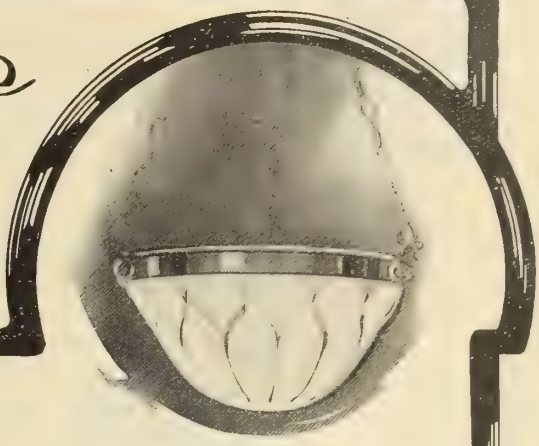
331 King St. West, Toronto, Canada

Munderloh & Company, Limited
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John Starr Son & Co., Limited
Halifax, N.S.

St. John Railway Company
St. John, N.B.

You, too, should feature *Delica White Lighting Glassware*





IT'S profit to you — that's the only basis upon which we urge you to handle Delica White.

¶ There is only one basis upon which we urge you to handle Delica White, and that is—***it's profit to you.***

¶ Its remarkable popularity is the result—not of chance, by any means—but of ***sterling quality,*** plus the knowledge gained by a ***carefully systematized study of the public taste and need.*** In other words,

It is a perfect glassware—made the way the people want it!

¶ In diffusing powers it is unrivalled. No matter how intense the light, Delica White completely breaks all glare. Its color is an indescribable variety of white without speck or spot, very decorative and agreeable to the eye. It is made for both direct and semi-indirect installation—simple or elaborate.

¶ *The price is reasonable.* There is absolutely no reason why you should handle inferior ware when you can sell Delica White at the same price, make the same profit on each sale, *and make twice as many sales.*

¶ We want you to try it. Give it a chance to prove its salability. You will find it the strongest member of your lighting glassware family. Write for our new catalogue.

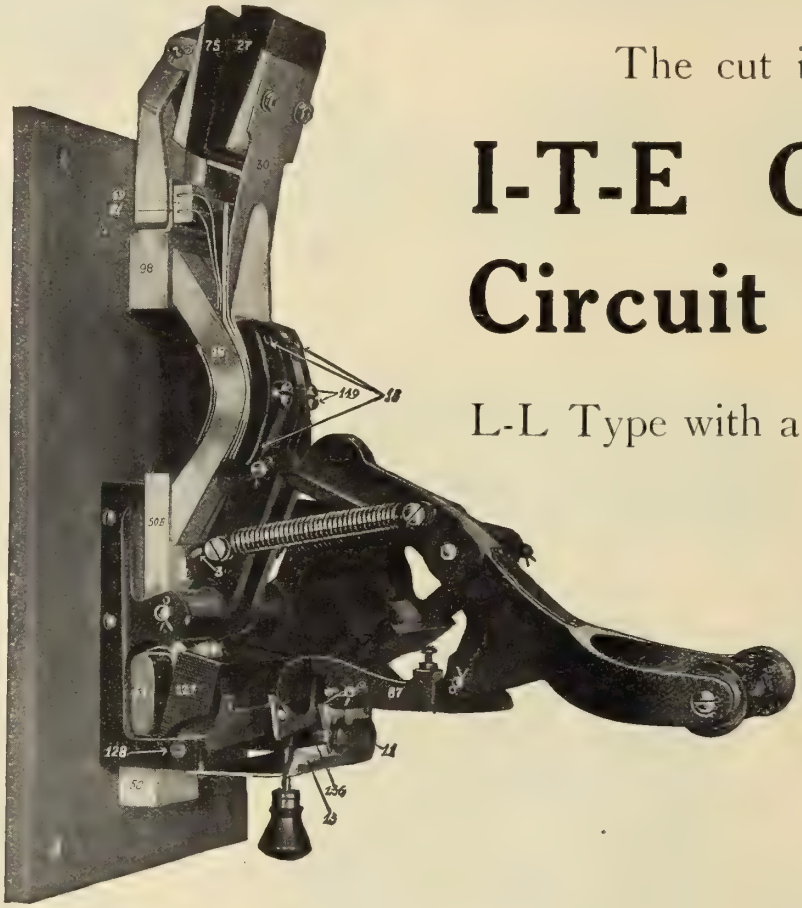
The Pittsburgh Lamp, Brass & Glass Co.
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119 Wortley Road, London, Ont.

PITTSBURGH

R. E. Davis, Representative

Perhaps no one piece of electrical apparatus is more widely used than the I-T-E Circuit Breaker. Certainly none has a higher reputation for effectiveness and reliability.



The cut illustrates an

I-T-E Overload Circuit Breaker

L-L Type with a part of the housing removed, showing the admirable simplicity of the working parts.

For more detailed information as to this and other types of I-T-E Circuit Breakers see the new I-T-E CIRCUIT BREAKER HAND BOOK.

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The Lachute Shuttle Co., Limited

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Manufacturers of

Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.

We Purchase Outright entire issues of bonds on steam and electric railroad, gas, electric and hydro-electric properties.

N. W. HARRIS & CO.

Established 1882
Incorporated 1911

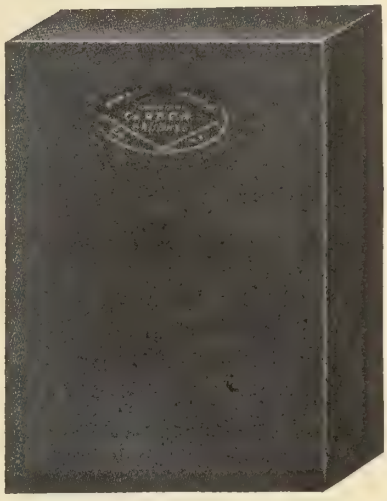
35 Federal Street, Boston, U.S.A.

Sparkless Commutation Demands

CERTAIN, DEFINITE BRUSH RESISTANCE

depending upon the design of the motor or generator. Further—

A Definite Degree of Abrasiveness Is Necessary in Brushes



to keep the mica insulation of the commutator flush with the copper segments.

TUNGSTEN Pure Carbon Brushes

are classified in an entirely new way which makes it easy to select the brush best suited to your service. We classify brushes with respect to voltage, current density, resistance per cubic inch and abrasiveness——the latter under seven divisions.

Pure Carbon Company
Wellsville, N. Y.

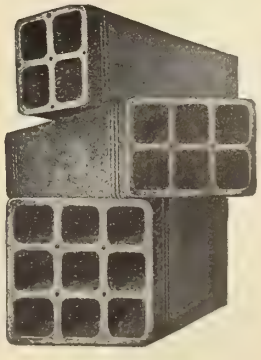


Clermont Sewer Pipe Co.

Multiple and Single Duct Conduit for Underground Work

We challenge the world on finish and durability of our material. Our plant is located giving us the lowest freight rates to Canada.

B. S. BARNARD, Vice-Pres. **50 Church St., New York City**





Permant Efficiency Plus Durability

SCHWARZE ELECTRIC BELLS

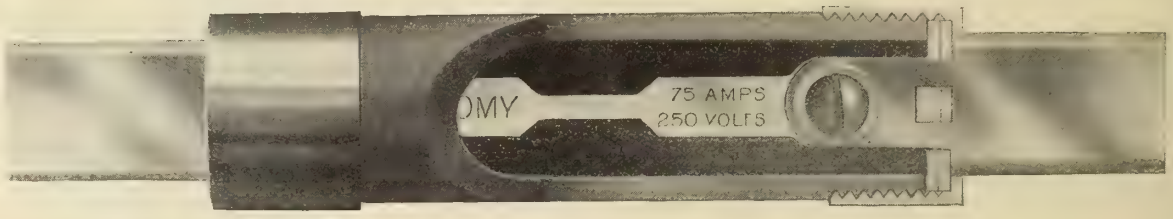
We make one grade of electric bells only—the very best that can be produced for all positions where an electric bell is desired and for all conditions of service.

No. 22, Standard Bell, illustrated herewith, is for use on Battery or High Tension, Direct Current Circuits. The bell is entirely insulated from the frame; is fully approved by the Underwriters; is remarkable for its quick response and instant stopping and is (like all Schwarze Bells) absolutely guaranteed.

Write for our Catalog—it is complete in its description and illustration of our high grade line.

SCHWARZE ELECTRIC CO. **Adrian, Mich.**

Norton Telephone Co. Toronto, Canadian Agents



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
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Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

Two Economy Renewal Elements are now furnished without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

Economy Fuse & Mfg. Co. of Canada, Limited

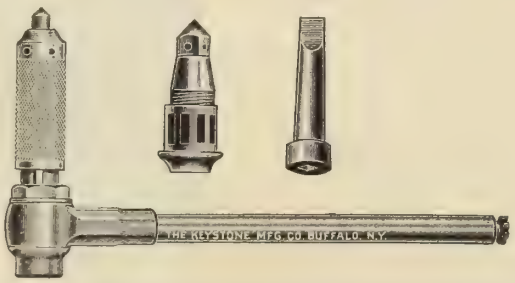
Herald Building, Montreal

REVERSIBLE RATCHET

COMBINATION NO. 200

Consists of

RATCHET FOR TAPER SHANK TWIST DRILLS. SLEEVE FOR SQUARE SHANK DRILL, AND SHORT BOILER SOCKET FOR SQUARE SHANK DRILLS (SOCKETS INTERCHANGEABLE)



The Keystone Mfg. Co., 42 Chandler St., Buffalo, N.Y.

DOSSERT CONNECTORS

are being put to the

Severest Test

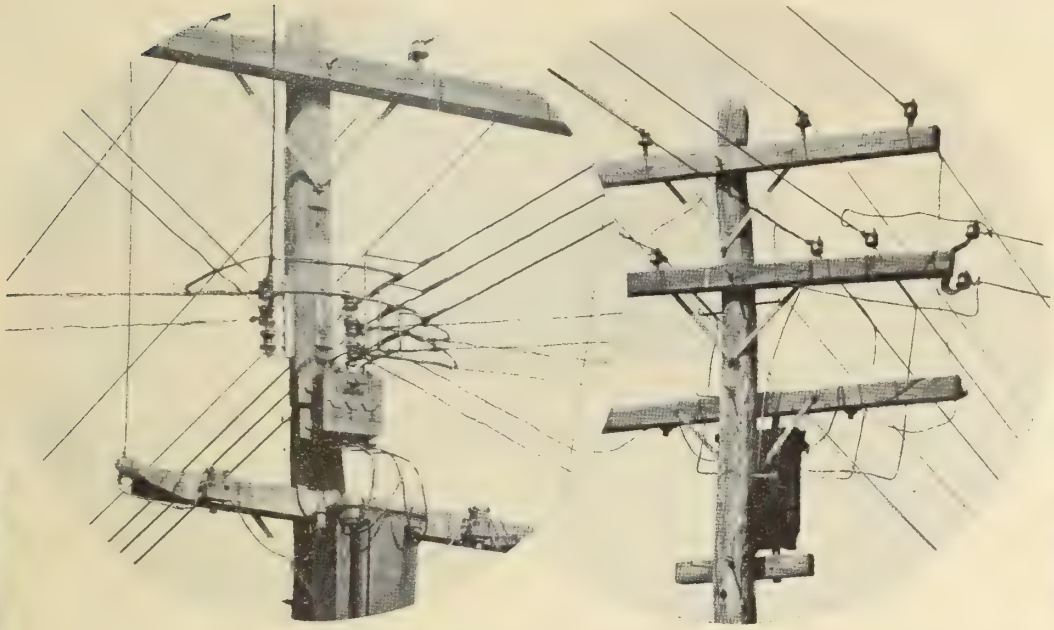
in many of the great central and sub-stations in the Dominion.

Where tubing and solid bus are to be tapped they are invaluable.

Troubles due to faulty joints are eliminated, while costs are reduced by the facility and simplicity of their installation.

DOSSERT & CO., H. B. LOGAN, Président

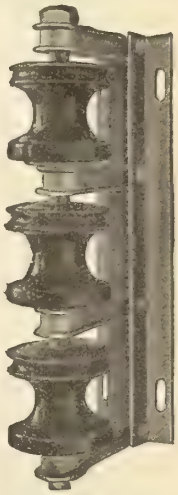
242 West 41st Street, NEW YORK.

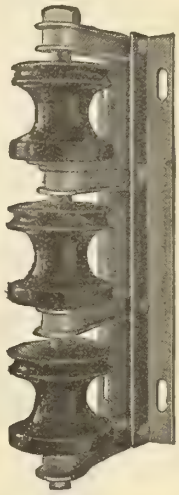














The Old Horizontal System of Distribution

is Due for a Total Eclipse

It involves expensive, unsatisfactory crossing of wires and heavy up-keep expense. It crowds the pole with only a few service connections, and it looks ragged. If you want to save first cost and maintenance cost, adopt

Vertical Distribution with Peirce Secondary Racks

You will reduce inductive drop, because the wires can be strung close together without danger of touching. You will get uniform sag—you will avoid crossing of wires. You will get greater strength at lower first cost and negligible maintenance cost.

If you figure in everything from first cost to interest and depreciation, you'll find the saving amounts to nearly 85 per cent.

Remember that Peirce Secondary Racks are backed by the Hubbard Guarantee, which knows no time limit.

Peirce specialties and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.

The Hardware MAKES the Line
Hubbard Makes THE Hardware

Hubbard and Company

Pittsburgh, U. S. A.



Keystone Strain Insulators Are Strong

They are hard and tough. Have great resistance to both compression and shear. Have great electrical resistance. They are given a heavy brown glaze and are designed with protected end coverings through which the guy wires pass, thus making it impossible for them to ever come in contact with each other.

Just compare the following strengths of Keystone Porcelain Strain Insulators with any other types you have in mind. Three samples of No. 1 were tested; two of No. 2; two of No. 3.

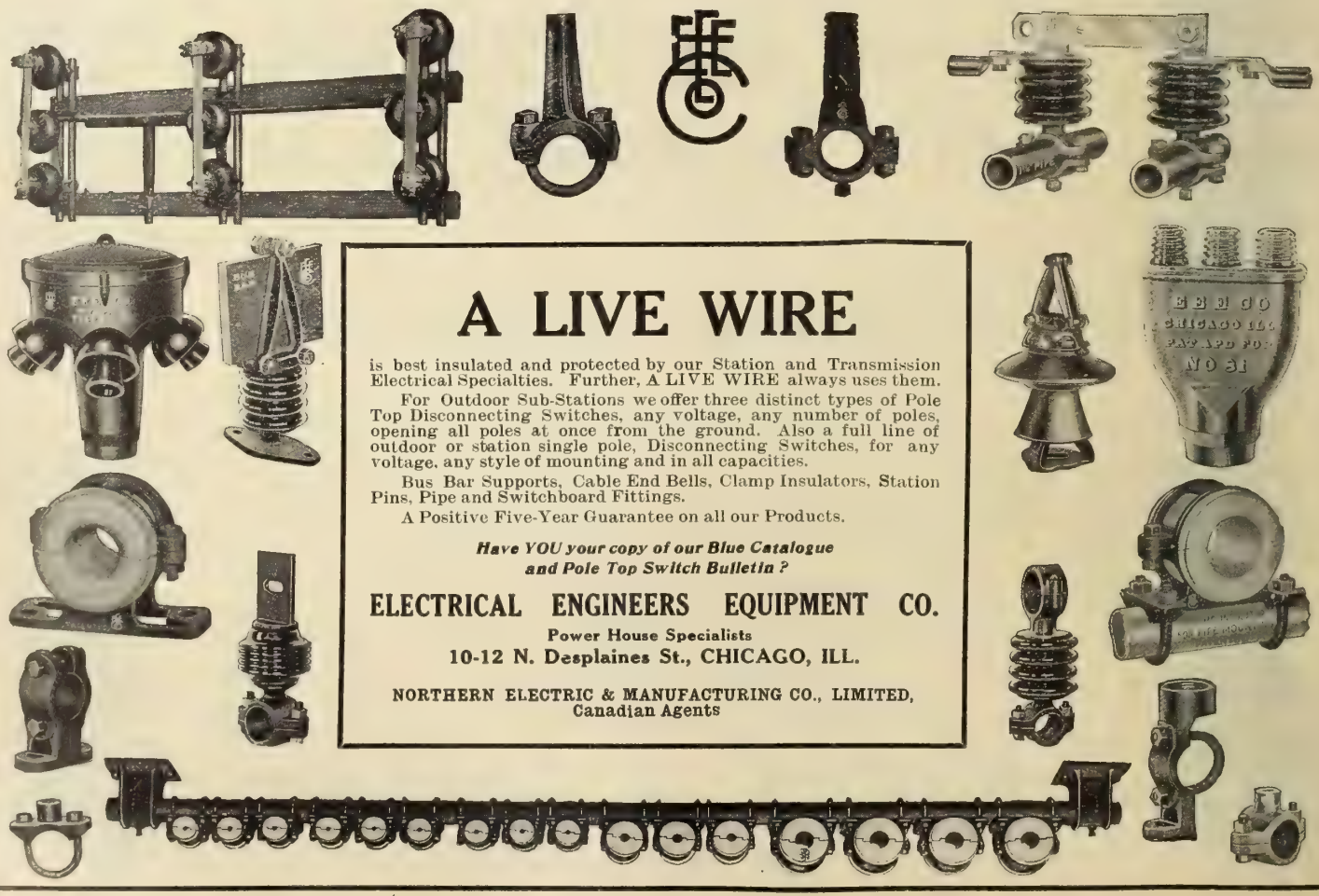
ELECTRICAL TESTING LABORATORIES

No.	Ins. Length	Average Load First Crack	Average Load Ultimate
1	3	16,600 lbs.	....
2	3½	21,350 lbs.	27,600 lbs.
3	5½	24,650 lbs.	29,575 lbs.

Isn't this the kind of porcelain strain you want to use on your work? Get samples or quotations either from John Millen & Son, or ourselves.

JOHN MILLEN & SON, LIMITED
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TORONTO MONTREAL WINNIPEG VANCOUVER

ELECTRIC SERVICE SUPPLIES CO.
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A LIVE WIRE

is best insulated and protected by our Station and Transmission Electrical Specialties. Further, A LIVE WIRE always uses them.

For Outdoor Sub-Stations we offer three distinct types of Pole Top Disconnecting Switches, any voltage, any number of poles, opening all poles at once from the ground. Also a full line of outdoor or station single pole, Disconnecting Switches, for any voltage, any style of mounting and in all capacities.

Bus Bar Supports, Cable End Bells, Clamp Insulators, Station Pins, Pipe and Switchboard Fittings.

A Positive Five-Year Guarantee on all our Products.

Have YOU your copy of our Blue Catalogue and Pole Top Switch Bulletin ?

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NORTHERN ELECTRIC & MANUFACTURING CO., LIMITED, Canadian Agents

Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, July 15, 1913 No. 14

Railway Extensions as Local Improvements

While the East is cautiously discussing the advisability of adapting the "Local Improvement" plan to its street railway extensions, being unwilling to venture into a somewhat unknown field, the West has shown itself, as usual, more ready to grapple at first hand with the difficulty and in one case at least, in Edmonton, they have succeeded in obtaining the necessary power from the local legislature. At the last session of the Legislative Assembly of the Province of Alberta, the Edmonton charter was so amended that "Local Improvements" now include "the construction or extension of any tramway or street railway along any highway," the same to be paid for by a frontage assessment on the land facing the street along which the line runs, and also on land in the vicinity likely to be affected by this improvement. Not only is it possible by the new act to carry out these extensions on the "local improvement" plan, but it is specifically stated in the charter that no part of the cost of any "local improvement" shall be borne by the city at large unless the council, by a special by-law shall so provide. All "local improvements" may be initiated in either of two ways, (1) by petitions signed by at least two-thirds in number of the persons registered or assessed as owners of land abutting on the street, or of lands to be benefitted by the "local improvement," representing at least one half in value of such land or, (2) by report of the commissioners adopted by resolution of the council.

Edmonton's success will be watched with interest by many cities and towns in Canada, but in as much as transportation facilities have been the basis of most of our past developments it is difficult to foresee, at least in theory, that there is anything wrong with Edmonton's idea of development. That this is an authority that might be abused by the city council is another matter. However, even if the principle is overworked, the possibilities in favor of its success are still many, and with development as we have seen it in the last ten years Canada has little to fear from transportation extensions in any direction or by any means.

A Sane Fourth of July

For the first time since New York City began celebrating a safe and sane Fourth of July no money was spent this year for fireworks. Instead of dangerous pyrotechnical displays the Mayor's committee decided to omit them entirely in favor of electrical illuminations in the various public parks and on public buildings and monuments.

There were fifteen places in Manhattan and the Bronx where electrical illuminations were arranged. Eleven of the points are in Manhattan and four in the Bronx. Seventeen thousand electric bulbs of eight candle power each were used, making a total of 136,000 candle power of illumination. Three nights were scheduled for the lights to be turned on, July 4th, 5th and 6th, from 7.30 p.m. until midnight. All of the current required for the illuminations on these three nights was given to the city by the New York Edison Company, the only cost to the city being the stringing of the lights which was done by a number of private electrical contractors. The illumination on the City Hall and on the Bronx Boro Hall was donated by the Edison Company, including the lights and wiring, without any cost to the city whatever.

The illuminations in Manhattan were: City Hall, 3,000 lights, outline of building; Washington Arch, 2,000 lights, arch outline; Seward Park, 1,000 lights, structure in park outlined in lights; Tomkins Park, 1,000 lights strung through the trees; Columbus Park, 1,000 lights in the trees; Chelsea Park, 2,000 lights, poles erected and lights festooned from pole to pole; Central Park, 3,000 lights; Sailors' and Soldiers' monument, 1,000 lights; Thomas Jefferson Park, 1,000 lights; Grant's Tomb, 800 lights.

The illuminations in the Bronx were: Bronx Hall, 2,000 lights; McKinley Square, 700 lights; St. James Park, 500 lights; St. Marys Park, 1,000 lights, hung in streamers from a large pole in the centre of the park.

1500 Volts d.c. in Melbourne

As already announced, the Victoria Government, Australia, decided in December, 1912, to electrify the extensive system of suburban railways of Melbourne. The direct current system has been adopted in accordance with the advice of their consulting engineer, Mr. Merz, of London, who after thoroughly investigating the tenders submitted for alternating and direct current installations, came to the conclusion that in this case a direct current installation would be the most suitable. A 1500 volt direct current system (multiple unit system) with overhead supply has therefore been chosen. The total length of single track, including sidings to be electrified, is about 323 miles.

The order for the machinery for the twelve sub-stations was placed with one of the Siemens Companies, of London, and comprises amongst other apparatus the following machines:—14 rotary converters, 2,000 kw. each; 10 rotary converters, 1,000 kw. each; 4 rotary converters, 500 kw. each; together with the necessary transformers. The transformers are supplied with 3-phase current at 19,000 volts. The reactance necessary for obtaining the proper regulation of the rotary converters is built in with the transformers. Six-phase current supplied to the three-phase side of the rotary converters, and on the direct current side at 1,500 volts, is supplied from a single commutator.

International Electrical Congress

Preliminary plans for the International Electrical Congress to be held in San Francisco during the week beginning September 13th, 1915, in conjunction with the Panama-Pacific International Exposition, and under the auspices of the American Institute of Electrical Engineers, are being effected by the Committee on Organization. In the week preceding the Congress there will be a meeting of the International Electrotechnical Commission. The Congress is being divided into twelve sections as follows:—

1. Generation, Transmission and Distribution.
2. Apparatus Design.
3. Electric Traction and Transportation.
4. Electric Power for Industrial and Domestic Use.
5. Lighting and Illumination.
6. Protective Devices; Transients.
7. Electrochemistry and Electrometallurgy.
8. Telegraphy and Telephony.
9. Electrical Instruments and Electrical Measurements.
10. Economics of Central Stations and Systems.
11. Electro-Physics.
12. Miscellaneous.

In each section it is desired to include as many as practicable notable papers dealing with the status or the progress of the art. Offers of papers and suggestions in this connection should be directed to the secretary of the Committee on Organization, Dr. E. B. Rosa, Bureau of Standards, Washington, D.C.

Fountain Falls Development

Fountain Falls is situated on the Montreal River between Ragged Chute and the point where the river enters Lake Temiscaming. It will be remembered that the installations on this river consist of a hydro-electric plant at Hound Chute, an hydraulic air compression installation at Ragged Chute and another hydro-electric installation near the mouth of the Montreal river, but situated on one of its tributaries, the Matabitchouan river. This fourth plant, when completed, will consist of four units, two of which are now in course of construction. The electrical equipment is of the Swedish General Electric type, vertical shaft, 3-phase, 60-cycle, 150 r.p.m., 12,000 volts, being supplied through the firm of Kilmer, Pullen & Burnham, Toronto. The turbines, of 2,000 h.p. capacity, are being manufactured by the I. P. Morris Company of Philadelphia. The engineering work is in charge of Messrs. Viele, Blackwell & Bucks of New York. The installation is being made for the Northern Ontario Light, Heat & Power Company who now control all the other water powers in the Cobalt district.

Electrical Equipment of Dry Dock

Tenders were recently called for the construction of a dry dock at Lauzon, two miles east of the town of Levis, P.Q. The electrical equipment of this government work will be of considerable proportions as may be gathered from the following data:—

The generators will consist of three direct-current units, 550 volts, one of 1,500 kw., one of 750 kw., and one 300 kw. capacity. These will be driven by steam turbine or by triple expansion reciprocating engines. The generators will be built so as to allow connection in multiple if required. A d.c. lighting unit 100 kw. capacity, 220 volts to be driven by a vertical direct-connected compound engine mounted on the same plate will also be required.

The switchboards will consist of 2-in. polished marble of standard construction and will be provided with all necessary volt meters, ammeters, wattmeters, overload circuit breakers, and all necessary switches. A distribution board will also be required, fitted with the necessary switches for the different circuits for power and lighting distribution.

Motors will be required as follows: three of 1000 h.p. capacity each for the main pumps; two of 125 h.p. capacity for auxiliary drain pumps; one of 125 h.p. capacity to be geared to worm operating the rolling caisson; one 15 h.p. unit on rolling caisson; four 15 h.p. units to operate the main culvert valves; two 100 h.p. units each on the floating caisson to operate the pump; one 10 h.p. unit to operate the sluice valves in the floating caisson. Motors will probably be required also to operate two capstans to be placed on each side of the dock. All motors are to be provided with starting and speed regulating devices.

All wires and cables leading to the lamps around the dock and to the different motors shall be laid underground in lead pipes and properly insulated. The underground cables will be led in glazed tile conduits bedded in concrete. No wire shall be smaller than No. 12 B. & S.

The power station will be 100 ft. x 120 ft. divided into 2 rooms, each 50 ft. x 120 ft., by a 12-in. wall. The floor of the generator room will be of concrete 6-in. thick on a 9-in. foundation of broken stone. The concrete will be overlaid with red tile approximately 6-in. square. The interior walls will be lined with a wainscoting of white glazed tiles rising 6 ft. from the floor, the upper part being finished with pressed brick. The chimney for the power house will be 180 feet high.

The illumination will be by both arc and incandescent lamps. It is probable a 15-ton travelling electric crane will be required in the generating room.

Saskatoon's Rapid Power Extensions

A civic power plant that has more than doubled, and in fact almost trebled, its capacity, within a year is somewhat unusual, to say the least, and that is one of the reasons why the power plant of the city of Saskatoon has proved of unusual interest to electrical men in the western provinces since the beginning of the year.

At the first of the year 1913 Mr. A. G. Sangster, who had been in charge of the power and electric light system in Saskatoon for the preceding two years, resigned to go into the private contracting business, and Mr. Edward Hanson, of the Canadian Light & Power Company, was appointed by the city council as electrical engineer for the city and soon afterwards Mr. J. R. Cowley, also formerly of the same company, was secured to take the position of superintendent of the power house. At this time the city were installing the last of the Babcock & Wilcox water tube boilers. They have now a total of eight, each of 500 h.p. capacity, fed with chain grate stokers working under an induced draft and having one set of economizers for each battery of two. The present boiler capacity of the plant is therefore 4,000 h.p. At that time also the power house had one 850 kw. and one 500 kw. Robb-Armstrong reciprocating engine. Soon afterwards the installation of a 2,000 kw. Allis-Chalmers turbine was completed and the 500 kw. machine was moved to the pumping plant to be used as an auxiliary. Since that time tenders have been called, and will be in shortly, for a 3,000 kw. turbine to take the place of the 500 kw. machine moved away.

Numerous additions have also been made to the power house since that time. A rectifier house has been built as an addition and all the power plant rectifiers have been installed in this addition. Work is in progress at the present time to take out the entire front wall of the engine room and leave it in the form of a triangle which will give 23 feet additional space at the extreme end. On this added space it is proposed to build an entirely new switchboard of the remote control type with duplicate bus-bars and switch gear generally. This new switchboard will be put down to handle 14,000 kw. on the idea of gradually eliminating the recipro-

cating units and replacing them with turbine units. It is hoped in this way to avoid having to extend the engine room for some time to come.

The highest peak load for the past winter was 2,320 kw., but when the turbine is installed this fall it is hoped to have a demand of 3,500 kw. It is the intention of the electrical department to ultimately have all cable feeders leaving the power house laid under ground and with this idea in view all the ducts have been laid and when the extensions are made in the near future the whole system will be put underground for some distance. The electrical department are also installing a track scale for the purpose of weighing all coal coming into the power house. The basis of payment will be fixed by these weights.

Montreal Tramway Improvements

As the result of a conference between a special committee of the Montreal Council, the Controllers, and Mr. E. A. Robert, president of the Tramways Company, a provisional agreement has been come to concerning measures to be taken to improve the service, and to avoid congestion at the rush hours. The basis of the agreement is the report submitted by Mr. G. Janin, the city's chief engineer, which has been ratified by the Council. The most important recommendation is for fifteen new routings and modifications of routings, while among the minor recommendations are the elimination of stops, increasing the switchmen, the improvement of signs on the cars, the cessation of smoking on the rear end of the cars, and the control of traffic at central points. Mr. Robert is of opinion that the report by Mr. Janin does not go far enough, and that it will make for only temporary relief. He suggests that later a more general plan should be worked out to meet conditions due to the growth of the population.

Some 1,200 men are being employed by the Montreal Tramways Company in relaying tracks in different parts of the city, part of an extensive programme which will be carried out during the next few months. The old rails of 96 lb. are being replaced with rails of 116 lb., the guard rails being increased to 132 lb. These will be the standards for the future. In all sections special cedar ties are being laid down, the length being increased from seven to eight feet, while they are put two feet apart instead of six feet. The roadbed has been greatly strengthened, with a view to resisting the frost. Eight inches of crushed stone are followed by two inches of stone dust as a bed for the ties, then comes six inches of concrete, the blocks being laid on this mass and grouted with cement, making a bed of 21 inches in depth.

After a long legal fight, the Montreal Tramways Company have obtained judgment, by the Court of Review, dismissing a conciliation board appointed by the Minister of Labour to consider a dispute between the company and certain ex-employees. Several conductors and motormen who were dispensed with secured the co-operation of an American street railway trades union, with the result that a conciliation board was appointed. Legal proceedings followed, and Mr. Justice Greenshields, in the Court of Review, has now held that none of the employees were members of the trades union which secured the appointment of the board of conciliation. He had no hesitation in deciding that the resolution on which the application for a Conciliation Board had been based had not been properly and legally passed by such a body as could be recognized by law. It had been contended that, when the Minister had appointed a board, his decision was final.

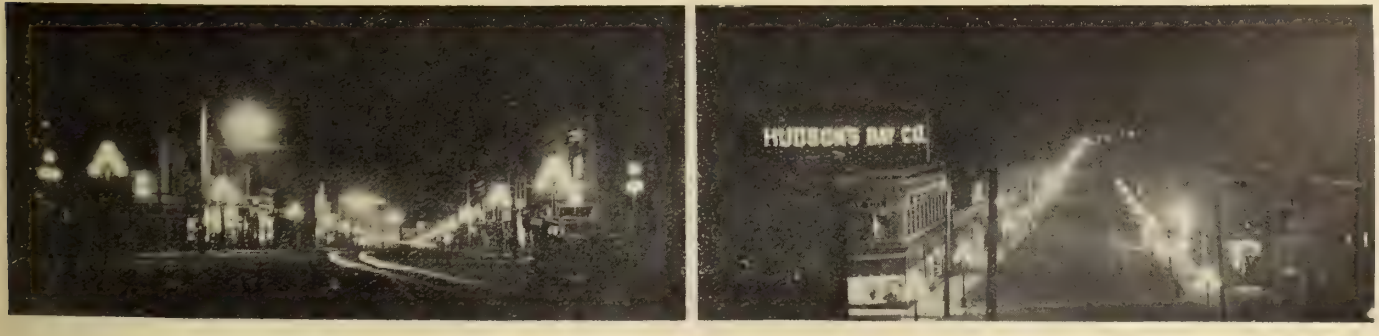
Kamloops—The Meeting of Waters

Kamloops is often spoken of as the Inland Capital of British Columbia, being delightfully situated at the junction of the North and South Thompson Rivers, from whence it receives the name Kamloops—an Indian word meaning "the meeting of waters." Kamloops might also be called the meeting of railways, for with the Canadian Northern cutting the country from north to south, and the Canadian Pacific from east to west it is apparently destined to become the distributing centre for all the surrounding district.

Owing to the rapid expansion of the city, and the ever increasing demands on the electric light and water-works plants it recently became necessary to take some steps to provide a method of meeting this demand. The City Council, therefore, engaged Messrs. DuCane, Dutcher & Company, of Vancouver, to locate, if possible, a water power site within a reasonable distance of the city; this firm succeeded in locating a suitable falls on the Barriere River, a tributary of the North Thompson, about 40 miles north of the city, capable of ultimately developing 10,000 h.p. and at the present time a dam has been constructed on this river and the contractors are already busy on the flume. It is expected to have the first 2,000 h.p. delivered at Kamloops in the spring of 1914. A sub-station to receive the incoming supply of 40,000 volts is also being built, together with a steam reserve plant consisting of two 750 kv.a. Curtis steam turbine units, and four 250 h.p. Babcock and Wilcox boilers. In the same building there is also being installed two motor driven turbine pumps, and one steam driven turbine pump having a combined capacity of 3,600 Imperial gallons per minute for the city's water works service.

Kamloops is also undoubtedly one of the best illuminating cities in the west, the outlying portions being lighted with series tungsten lamps of 80 c.p.; nearer in arc lamps are used, and on the main streets and avenues over 3 miles of "cluster" lights have been installed with the standards 100 feet apart.

A brief description of this cluster light system is of interest. It was designed and installed by Mr. C. L. Wain, chief engineer and superintendent of the Water & Light Departments of the city of Kamloops, who, after visiting several of the Pacific Coast cities, also came to the conclusion that the series system was more effective than the multiple system. Owing to the cement sidewalks being narrow, the stan-



The beautifully illuminated streets of British Columbia's inland capital.

dards are placed on bases run out from the sidewalks, bringing the standards just clear of the pole line. These bases will, when the streets are paved, be jointed by a curb. The standards used were made by Messrs. Hutchison Bros., of Victoria, and carry 5 lights each on the main street and 3 lights each on the avenues. The lamps are 40 watt mazda with 12-inch alba globes. Lead covered wire run in 2-inch fibre conduit, laid in 8 inches of cement, was used for the circuit. Two wires are run, each standard being connected on alternate wires; this divides the system into two circuits, one of which is cut out at midnight while the other is left burning until daylight. The accompanying sketch shows different views of Victoria street, Kamloops.

Power Developments on the Abitibi

Work is well under way in connection with the first hydro-electric installation of the Abitibi Pulp & Paper Company at Iroquois Falls on the Abitibi River. At this point, according to Mr. Henry Holgate, consulting engineer, there is a head of 35 feet obtainable with a regulated flow of 6,500 c.f.s., which will give approximately 20,500 h.p., figuring 80 per cent. wheel efficiency. Two other falls on the same river and between Iroquois Falls and Lake Abitibi will give respectively 32 ft. and 36 ft. of head. These are named Twin Falls and Couchiching Falls, the latter being only a short distance from Lake Abitibi. The flow at these two latter points is only calculated at 6,000 c.f.s. on account of an increase in flow just below Twin Falls, due to the entrance of the Black river into the Abitibi. The total available horse power at these three points is, therefore, between 57,000 and 58,000 h.p., being approximately 20,000 at Iroquois Falls as stated above, 17,000 at Twin Falls and 20,000 at Couchiching Falls.

According to Mr. Holgate's report the conditions of regulation are very nearly ideal. The Abitibi Lakes have an area of 355 square miles and the area of the water shed tributary to these lakes is placed at 4,300 square miles. These lakes will form an ideal storage basin, for which purpose a temporary dam is being located at the point where the river Abitibi leaves the lake. The installation at Iroquois Falls, the first of these points to be developed, will consist initially of nine pairs of water wheels, each pair in a separate flume, and each of these pairs of wheels will be direct-connected to two wide pulp grinders. There will also be two other flumes, each with a pair of wheels, duplicates of those used for the grinders, but these will be direct-connected to electric generators for furnishing power to drive all equipment except the grinders, and for lighting. Each pair of wheels will be capable of generating, at full gate and 80 per cent. efficiency, about 1,500 h.p. The electric generators will each have a capacity of approximately 1,000 kw.

In all probability the developments at Twin Falls and Couchiching Falls will be entirely hydro-electric, current being transmitted to Iroquois Falls, which is considered at the present time the most satisfactory location for the manufacture of pulp and paper. When Couchiching Falls is developed it is planned that the permanent dam at that point will take the place of the present temporary timber structure for regulation purposes, as there is practically no fall between Lake Abitibi and the Couchiching Falls.

Mr. George F. Hardy, the engineer who has designed the pulp mill, reports steady progress to date. The upper cofferdam is now water tight and the lower one will be completed within a few days. They are practically ready for the foundations both of the buildings and of the dam, and the concrete work will start before the end of July. At present the materials for the concrete are being brought down the river by barge, but when the six-mile branch line of the T. & N. O. is completed, which it is expected will be about July 15, the materials will be brought in by that route. The saw mill is working at full capacity and is producing enough lumber for the forms for construction.

Contracts for machinery have been awarded as follows, to date:—turbines, Holyoke Machine Company; generators, Canadian Westinghouse Company; motors, Canadian General Electric Company; structural steel, Lackawanna Steel Company.

Recent Extensions in the City of Port Arthur

The City of Port Arthur have made a large number of electrical extensions during the past few months as indicated by the following items, which are of special interest as showing the continued activity of this progressive city.

Electric Light Department—20,000 feet of primaries and 40,000 feet of secondaries have been strung during the past year. Also 265 new services have been added, making a total of 3,089. There have been installed approximately 1,000 meters in the last twelve months.

Power Department—A 500 kw. motor-generator set has been put in operation in the Hydro-electric sub-station, and 30,000 feet of 4/0 d.c. feeders have been strung for the municipal street railway system. A new storage dam, at Current River, has been put into service, giving a regulation of 48 hours in place of 12 on the old dam. This dam cost approximately $30,000. The Hydro-electric Power Commission of Ontario have been asked to make a new survey of Dog Lake with a view to getting a supply of power there. In a former estimate prepared by the late Cecil B. Smith, he stated that power could be furnished from this lake to the city of Port Arthur at approximately $10 per h.p., high tension, and the citizens are looking forward to the development of this power, which would give industries a very low rate. The city are selling power at the present time at $25 for twenty-four hour service and $20 for ten-hour power, based on peak load. The present load is approximately 5,000 horse-power.

Street Railway Department—Ten new cars have been purchased of the "Pay-as-you-enter" type, and all the cars have been equipped with automotoneers and p.a.y.e. fare boxes, manufactured by the Toronto Railway Company. 80 lb. steel has been laid on a number of streets where permanent pavement has been placed. A main line extension approximately 2 miles long, and a belt line approximately 7 miles in length, single track, are in course of construction. The system operated 33 cars on July 1st, carrying 35,000 passengers.

Street Lighting Department—The street lighting system has been extended considerably during the past year in this city. 75,000 feet of No. 6 primary feeders and 145,000 feet No. 6 secondaries, with the necessary cross-arms, have been erected. There is now a total of 2,165 multiple incandescent lamps on the streets, 730—60 watt and 1,435—100 watt. The charge to the city for this service is $5 per annum for 60 watts and $8.30 per annum for 100 watts. This includes renewals, attendance and maintenance. The city is now one of the best lighted cities in the Dominion and the rate charged for the service is one of the lowest, if not the lowest, in Canada.

Telephone Department—This department have 2,501 telephones in service at date and have free exchange with the city of Fort William and the surrounding municipalities, making a total of over 5,000 telephones with which the customers have free connection. There have been laid, during the past year, 5,220 duct feet of underground conduit, and 8,700 feet of 400 pair cable. At the present time they have under construction a 1,650 line switchboard which will give a capacity of 3,750 lines. There is also in course of installation 1,780 feet underground conduit; 1,200 feet 400 pair cable; 8,000 feet of 200 pair cable; 7,200 feet of 100 pair cable, and 6,000 feet of 50 pair cable. The average calls per day are approximately 26,700.

Underground Distribution

For Small Cities and Large Towns—Single Core Cables Laid Solid in the Earth

By Mr. S. Bingham Hood*

During recent years, the development of civic pride has created a widespread demand for an improvement in the appearance of the streets of our cities and towns.

Unsightly overhead electrical construction has, without doubt, been a strong factor in leading this civic pride to the point of demanding, and insisting upon, the removal of this class of construction, and substituting a system of underground distribution.

In our larger cities the load density makes overhead construction, in the congested districts, a difficult and expensive proposition; consequently economic requirements and esthetic demands are very apt to become coincident factors, and underground construction is not a burden upon the operating company.

In the case of our smaller cities, however, the problem is vastly different. The load density, and corresponding income, do not warrant expensive underground distribution; consequently yielding to the demand for this class of distribution must inevitably place an additional burden upon the community as a whole, or at least that portion of the community who patronize the local distributing company.

Some of our municipally operated systems are handling this proposition by charging the cost as a local improvement against the abutting property owners. This idea is somewhat amusing in that the cry for "all wires underground" becomes very much subdued when those immediately affected find they must back up the demands by cold cash.

Unfortunately for the private company, they have no practical means of dealing with the matter in this way; consequently their only resource is to grin and bear it until such time as the growth of the business has increased the net revenue to a point where all its customers are paying an excess profit sufficient to cover the increased overhead cost due to underground construction used only to supply a few. In other words, underground construction means maintaining a rate for current which, with overhead distribution, could have been reduced without lowering the net revenue below the point where a fair return on the investment is earned.

In the vast majority of cases, the local company are themselves, to a considerable extent, responsible for the underground construction demand, in that they have maintained a class of overhead construction so slip-shod and unworkmanlike in appearance that it is a continual eye-sore to the public. Such construction, with present day standard fittings available at very moderate prices, is inexcusable; consequently a company which persists in offending by maintaining, and continuing to erect, a class of construction based on the old telegraph standard of thirty years ago, and looks as if it had actually been erected at about that time, deserves all it gets in the line of public criticism.

The writer had the pleasure of bringing to your attention last year a type of overhead construction which he believes comes as near eliminating the unsightly appearance of distribution lines as possible, except by actually placing them underground; and will take great pleasure in showing any of your members interested actual examples of the type of construction then advocated, and now standardized in Toronto. This construction should prove particularly interesting in that it can be immediately compared to old types of construction in the vicinity, and to recently erected lines on what are claimed by competing engineers to be the last word in overhead distribution.

The object of this paper is to endeavor to outline a type of underground distribution which has been tried out successfully in this city for these locations where the demand for "underground" has been such that no form of overhead construction would have been acceptable.

We will not attempt to go into the whole problem of general underground distribution, but will confine ourselves to the problem which so many of you are now facing; namely, the elimination of poles and wires from the main streets of your city.

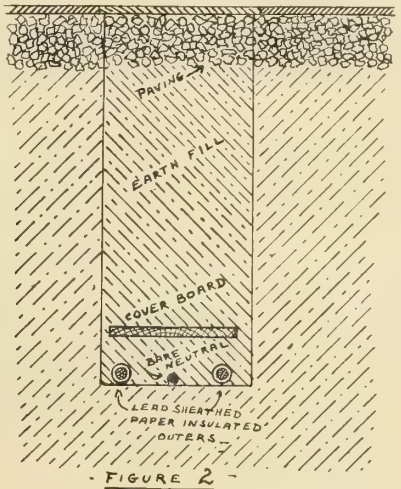
This problem permits of locating your transformers on poles located on intersecting streets and terminating your high tension lines on these poles. The problem then becomes one of low tension distribution only, which involves no complicated conditions and resolves itself into a matter of striking a balance between first cost and reliability.

In our larger cities we find the original Edison Iron Tube System still in extensive operation; but being gradually displaced by a conduit draw in system. Here we see the condition of accessibility being given first consideration in the design. With the load density found in these congested centres, requiring extensive networks of feeders as well as mains, the relative cost of cables as compared to the housing (conduit) system is high. Consequently the possible saving by using a solidly laid system over that of a draw-in system is not so important, and accessibility can be given preference over first cost. Table 1 gives the cost of conduit systems under average conditions of city construction in sand or loam. By reference to this, and assuming that for a large

CLASS OF WORK.		COST IN DOLLARS PER FOOT									
		LABOR		CONDUIT		CONCRETE		REPAVING		TOTAL	
		DUCT	DITCH	DUCT	DITCH	DUCT	DITCH	DUCT	DITCH	DUCT	DITCH
SOLID SYSTEM	PAVED		.39						.30		.69
	UNPAVED		.22								.22
SINGLE DUCT	PAVED	.52	.52	.07	.07	.05	.05	.30	.30	.94	.94
	UNPAVED	.35	.35	.07	.07	.05	.05			.47	.47
3 DUCT	PAVED	.22	.66	.065	.195	.028	.085	.17	.52	.49	1.46
	UNPAVED	.16	.48	.065	.195	.028	.085			.25	.76
4 DUCT	PAVED	.16	.64	.06	.24	.025	.10	.105	.42	.35	1.40
	UNPAVED	.13	.52	.06	.24	.025	.10			.22	.88
6 DUCT	PAVED	.12	.72	.055	.33	.02	.12	.07	.42	.27	1.59
	UNPAVED	.09	.54	.055	.33	.02	.12			.18	.99
8 DUCT	PAVED	.10	.80	.06	.48	.016	.13	.05	.42	.24	1.83
	UNPAVED	.07	.56	.06	.48	.016	.13			.15	1.17
12 DUCT	PAVED	.07	.84	.055	.66	.012	.14	.045	.52	.18	2.16
	UNPAVED	.05	.60	.055	.66	.012	.14			.12	1.40

NOTE:- ABOVE PRICES EXCLUSIVE OF CABLE, MANHOLES OR HANDHOLES.

- FIGURE 1 -



- FIGURE 2 -

*Read before the C.E.A. Convention.

city system an eight duct line is the average size we find a cost per duct foot of about 24 cents. A heavy feeder cable in this duct will cost about 80 cents, so that the duct system represents, excluding manholes, about 23 per cent. of the total cost.

Applying this to a small local low tension distributing system using a four duct line we find the cost per duct foot to be 35 cents, or $1.40 per ditch foot; to which we must add

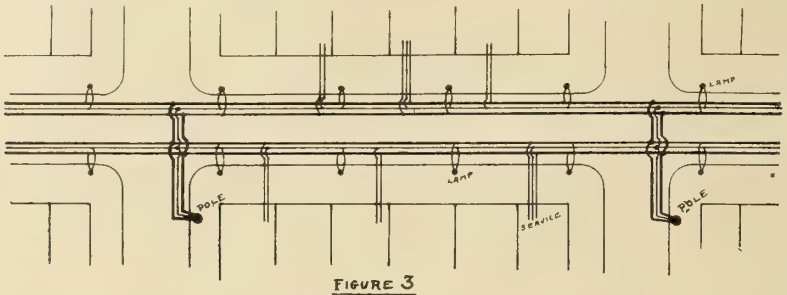


FIGURE 3

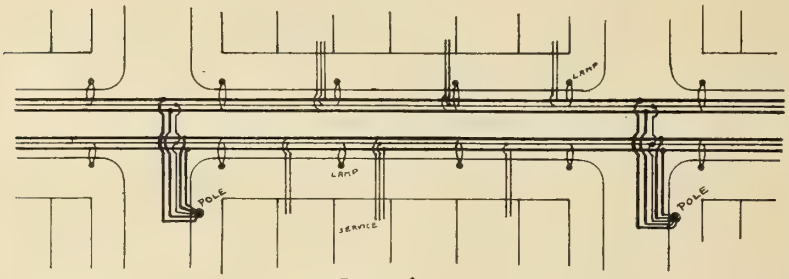


FIGURE 4

cost of a handhole about every 100 feet. This would bring the cost per ditch foot up to $1.65. The cable system for mains, using 250,000 c.m. lead outers and a 2/0 bare neutral would represent an investment of about 60 cents per ditch foot, or a total cost of $2.25 per foot of main; of which the conduit system represents over 70 per cent. This is the all-important problem for the engineer of the system in the smaller cities to solve; namely, is the accessibility feature worth increasing an already burdensome investment 70 per cent?

What could we save by laying our cables solid in the earth? By reference to the table and using the smallest size ditch, that suitable for a one duct line as being of the minimum width, and allowing 25 per cent. of the labor cost as representing that required to lay conduit with its concrete envelope, we get an approximate cost for a solid system as follows:—

Labor, per ditch foot	$ .39
Repaving, per ditch foot	.30
Cables	.60
Cover board	.03
Total	$1.32

This represents a saving over a conduit draw-in system of 93 cents per ditch foot, or over 40 per cent. Assuming that we can look reasonably well into the future as to load demands, which we usually can do in the case of substituting underground for overhead distribution in a small city, the main street of which has fairly well reached its final development, it looks as if this saving should be utilized if possible.

Lead cables laid solid in the earth are not subject to any deterioration other than mechanical injury, excepting what would exist if pulled into a draw-in system. For years and years past it has been common practice to lay lead pipe water services directly in the earth. Such services are maintained under identically the same conditions as a solidly laid lead cable system, and subject to the same chances as to chemical and mechanical injury. In addition they have the freezing element to deal with, particularly in our climate. Have the water works engineers found it necessary to lay conduits or other protective structures for these services, in order to give protection against mechanical injury or to provide for accessibility? Most assuredly they have not; therefore, why should we?

In England, the solid system of mains is almost universal practice and, at double our standard distribution voltage, is giving every satisfaction, and making it commercially practical to maintain an extensive underground network on load densities which would stagger the engineer of any of our smaller companies who might be called upon to face a complete underground proposition for his district.

The use of three core armored cables is the practice there, but this type of cable does not appeal to the writer for application to our conditions for the following reasons:

Reasons Against Armored Cable

First—The jute protection over the armor and between the armor and the lead sheath is bound to depreciate sooner or later, due to chemical action or mechanical injury. This leaves two dissimilar metals in close proximity in a chemically charged soil. Injury to one or the other or both, is bound to follow.

Second—In the event of earthing of the neutral and one outer, and alternating current being used, the armored sheath will cause an inductive drop which will prevent the other outer being continued in service and may cause heating which would ruin the entire cable.

Third—The advantage of continuing in operation one side of three wire system, when the other is in trouble, is of considerable value as affecting continuity of service. This is not possible with a three conductor cable and single

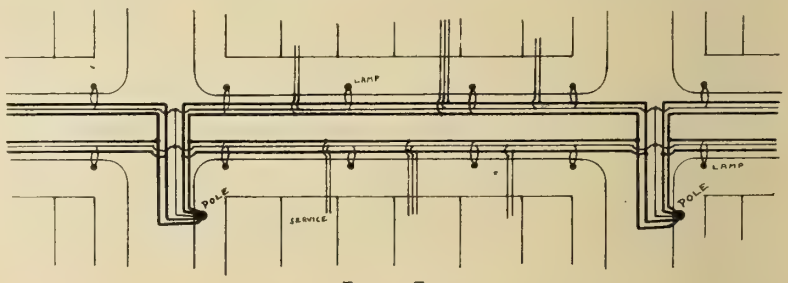


FIGURE 5

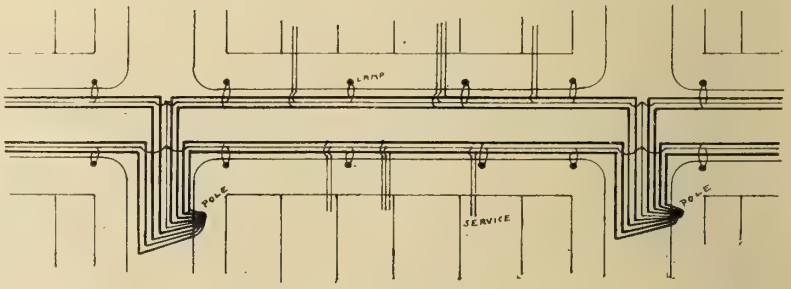


FIGURE 6

conductor armored cables can not be used with heavy alternating currents.

With the use of a solidly earthed neutral this conductor can be laid with bare copper, being simply in the form of a bond wire around the various earthing points located one at each customer's service.

We therefore require but two insulated and lead sheathed single conductor cables for a three wire system. The combined cost of these and the bare neutral will not exceed the cost of a three core armored cable, and we have all the advantages of two independent two wire systems as to reliability and continuity of service. In laying these cables, about four inches of earth should separate each conductor from the bare neutral, or about eight inches between the outers. The group of cables so separated should then be covered with from four to six inches of earth and a cover board of one inch rough lumber, corbolineum treated, laid down and ditch filled in. This gives a system of the utmost simplicity and one which any unskilled laborer can successfully lay with proper supervision. Fig. 2 gives a cross section of such a system and illustrates clearly its simplicity.

Now as to mechanical injury, which is the only one we have to deal with, as electrical injury with a solid grounded neutral and the most ordinary care in laying and jointing is practically eliminated with modern cable purchased under standard specifications from reliable manufacturers, on 600 volt rating.

Mechanical injury can occur in but one way—digging a hole down through the street surface to the cables. Anyone making such an excavation first hits the cover board, which not only requires considerable force to break through, but serves as a warning to almost anyone whose work makes him familiar with underground conditions along a city street.

Allowing that an unusual absence of brains does finally permit of getting through the cover board and down to the cables. The worst that can happen is a punctured cable which, in the ordinary small system, will blow the fuse, and resulting complaints would naturally lead to an investigation, which, with ordinary prompt attention, will catch the culprit before he has his ditch filled in. Repairs can then be made by stripping back the lead, re-insulating, and putting on a patch or split sleeve; or, better still, a split box which can be clamped around the cable and filled with compound. Now the chances of anyone cutting into the second cable after damaging the first are so slim as to be almost negligible.

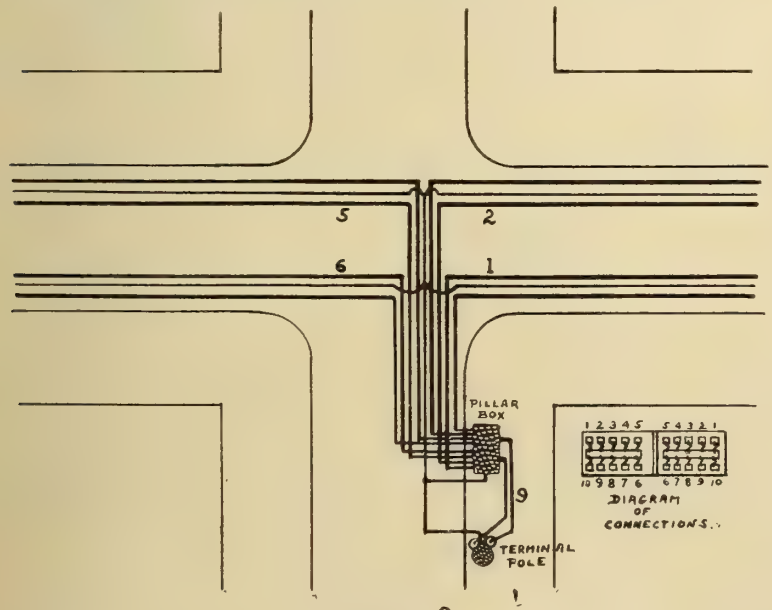


FIGURE 9

In the event of the puncture not blowing the fuses, the lead covering will burn away until it clears itself, in which case the ditch will probably be filled in and the damaged cable buried without repairs. This looks serious at first sight, but, as a matter of fact, would only result in a small leakage which, of course, should be repaired if possible, but would not interfere with operation of the system if left in the damaged condition. To illustrate the trifling leakage which would occur in a case of this kind just consider the common driven pipe ground connection which so many of us have endeavored to use for neutral grounds on our system, and have found practically useless for this purpose. Here we have a length of pipe probably eight feet long and three-quarters of an inch in diameter, with a contact surface of over one square foot. Under the most favorable conditions such a ground will not pass more than ten amperes at 110 volts and under average conditions probably not more than two amperes. Now compare this area with the area of a cable core which would be exposed by being cut into by a pick or shovel and it is at once plain that we would almost require a milliammeter to detect the actual leakage current.

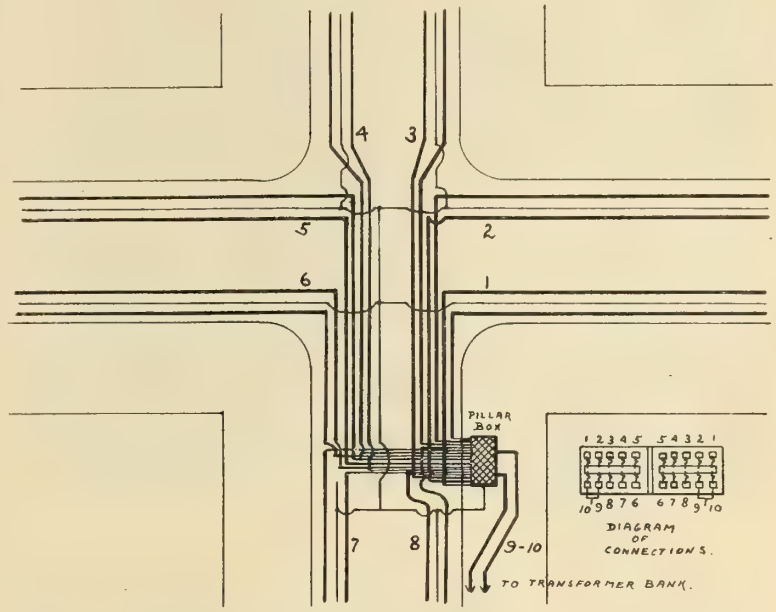


FIGURE 10

If we consider the unusual classes of injury, such as driving a bar through the street surface for attachment of derrick cables, blasting operations for deep sewer excavations, undermining for sidewalk vaults, earthquakes, and a thousand and one similar conditions which are in most cases improbable, the solid system will stand up better than a conduit draw-in construction. This is because the disturbance of a conduit line introduces a shearing action on the cables, while, in the solid system, the cables will give with each movement of the surrounding earth.

Now let us consider two other causes for damage to underground cables; namely, electrolysis and gas explosions. The first of these is due to stray railway return currents leaving the cable sheaths at definite points. In a conduit system these points usually occur at the hangers in manholes and where the cables are in contact with points in the duct line, as where cables touch the edge of ducts in bending around manholes and at joints in conduit where the cement has squeezed through and formed a little projection which is always more impregnated with moisture than other parts of the conduit. The old practice of preventing electrolysis was to insulate the lead sheaths from the earth, or at least try to insulate them. Usually the remedy was worse than the disease owing to it only being

possible to indifferently insulate at points in manholes open to inspection; consequently the leakage was transferred to unsuspected points back in the conduits and could not be detected until final breakdown had occured. The latest practice is to thoroughly ground all sheaths to earth and where distinctly positive to the rails to bond to these rails. This places the sheaths directly in parallel with the rails and permits them to carry a proportion of the return current continuously. Now with a solid cable system, all points of the sheath are in contact with the earth and the bare neutral is a continuous bond around cable joints or other weak sections. The earth acts as an excellent conductor of heat, and it is surprising the amount of return current that a pair of small cable sheaths will carry in this way without dangerous heating. Being uniformly earthed at every point there can be no sharp points of potential difference, and the entire system will drain itself without distress, under conditions such as would be found in connection with a tramway system for a small city, allowing that rail bonds were in fair condition. By fair condition, we mean sufficiently good to permit of ordinary operation of the tramway.

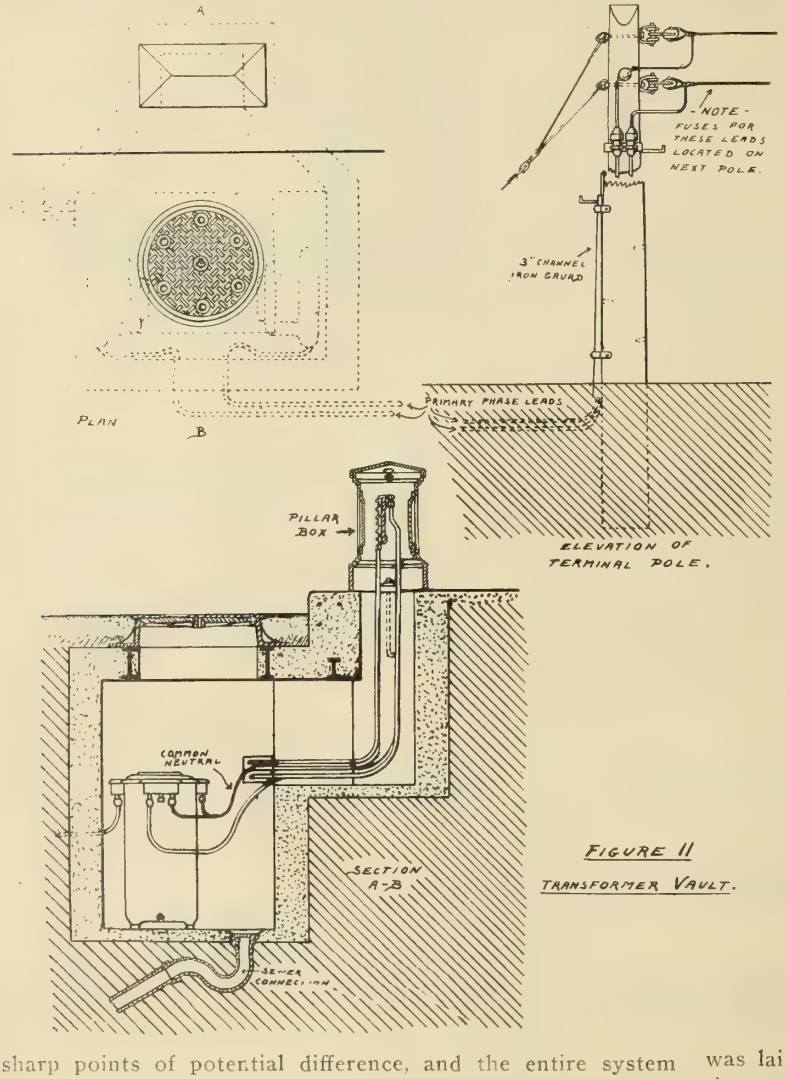


FIGURE 11
TRANSFORMER VAULT.

To illustrate the amount of return current which a cable sheath will carry in an emergency, the writer recently had occasion to investigate a conduit cable system where electrolysis was suspected. There were two cables in the system, each with a diameter over the sheath of about 2½ in. A bleeder cable was connected from these sheaths to the railway negative return cables, and ammeter readings showed as high as 600 amps. under peak load conditions, or 300 amperes per sheath. With this current the cables showed no signs of dangerous heating, even when carrying their usual currents up to nearly the rated capacity of their conductors. If these had been laid solid in the earth, probably no appreciable heating could have been detected. The simple solution of electrolytic troubles is found in providing an easy path for stray currents to leave the sheaths. In a solid cable system, the method of laying automatically provides this means at no additional cost.

Considering the danger from gas explosion in manholes and conduits, a solid cable system eliminates the cause of such explosions as it goes without saying that explosive gas mixtures can not form if there is no space for them to form in.

Having, we trust, demonstrated that a solid system is as good as a draw-in system as regards reliability, and that it is cheaper as to first cost and superior in some details, it only remains to take up the question of relative cost in the event of additional cables being necessary, over the capacity which can be foreseen at time of construction.

Let us forget the general problem of underground distribution as applied to large cities, and consider only that of a main street system for our smaller city. A main in one block becomes overloaded and requires additional copper. Now the natural thing to do is to run a sub-feeder from the nearest intersection, and tap into our existing mains at about the centre of the block. This means digging up one-half of our ditch in this block at a cost of 69 cents per ditch foot as per previous estimate. This means an increased average cost for the entire block of one-half this per ditch foot, or 35 cents.

Now if we had foreseen this condition at the start, and had laid a conduit system to provide for it we would have selected a six duct line. We probably would not have known from which intersection we would run our sub-feeder, and consequently carry the six duct line throughout the entire block, at an added additional expense of 19 cents per ditch foot.

Our original 4 duct line has been shown to have cost us 93 cents per ditch foot more than the solid system, so that to provide for this draw-in extension we have an excess investment of $1.12 per ditch foot made in order to save a possible future investment of 35 cents per ditch foot. Does not this clearly illustrate the desirability of the solid system of construction for small city construction under paved streets or sidewalks? If so, its desirability for use in residential sections where mains can be laid under grass plots and boulevards, with the elimination of repaving costs, is beyond question.

Before considering actual details of distribution for such a solid cable system the writer desires to mention actual results obtained from a system of this kind in daily service. There is in Toronto today somewhat over 6,000 feet of this type of mains which have been in use for over two years. This was laid in new residential streets where building construction was in process and the certainty of three ditches being dug over our main for every new dwelling erected. These streets are now solidly built up and no additional ditches can be expected except for repairs to services already laid. Under these severe conditions no interference or failures have occurred and in opening up for new services from time to time no depreciation is visible on the cables, which are in condition to-day equal to the day they were laid. It may also be interesting to note that this construction was in unfinished boulevards with sandy soil and outers were only of 2/0 cross section. The cost was about 80 cents per ditch foot or $1.60 per foot of street, mains being laid on both sides. The original supply for these streets was by overhead lines at a cost of about 30 cents per foot of street. This means that under the most favorable conditions underground construction will run not less than five times that of overhead.

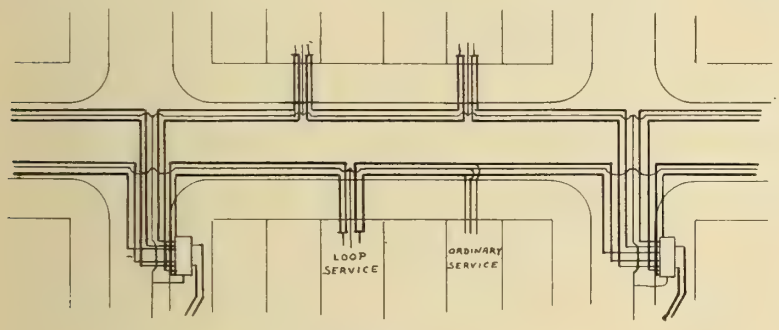
Coming down to actual selection of the system of distribution, we have two things definitely fixed in most cases; first, the supply to be alternating current derived from pole transformers erected on intersecting streets; and, second, a system of ornamental street lighting will be required in conjunction with the commercial system.

For street lighting of this kind the multiple system has definite and distinct advantages over any series system, and should be used in every case where ornamental posts with underground supply parallel the commercial mains. To obtain the maximum economy and simplicity we must connect these street lanterns to our commercial mains, which means individual control of the posts by the patrol system. At first sight this may seem somewhat crude and like going back to the old gas lamp days. However, just figure out various schemes of remote control for yourselves, and, if you find one which is cheaper than the one-boy power switching system, we will all be very much interested to receive details of same.

The simplest system of distribution is shown in Fig. 3, being a three wire main with service taps taken off for commercial loads and street lamps and the transformers feeding in through simple tapped branches at intersecting streets. The defect of this system is that a fault will shut down one, or possibly both sides of the system until it can be located or cleared.

Fig. 4 shows this defect partially overcome by laying each side of the street as separate sections, multipled at the pole head.

Fig. 5 shows a similar arrangement where each block is maintained as a separate unit. This is not advised owing to all street lamps in the block being out if both sides of the system fail for any reason.



- FIGURE 12 -

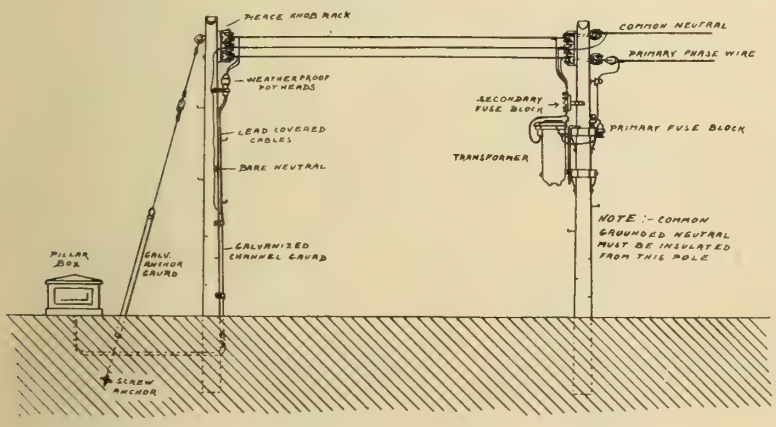


FIGURE 14

Fig. 6 shows the necessary arrangement to provide against extensive outages due to trouble on any section of the mains and provides for sectionalizing of the main on either side of any block. With this arrangement each block is fed from each end, transformers being located at the extreme ends of the system in order that no block may have its supply limited to one source. This arrangement permits of opening any main for repairs or changes without interfering with the supply to any customer.



Fig. 16

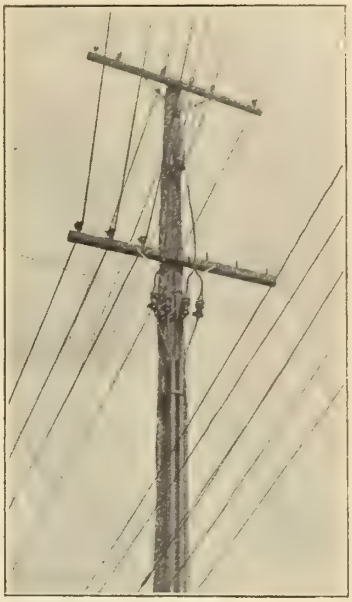


Fig. 17

This latter arrangement is a trifle more expensive than some of the simpler plans, but the additional expense is well warranted by the added convenience of being able to quickly sectionalize trouble and thereby get service restored to the majority of customers in a very short time. The trouble with such a scheme is the difficulty of making a good job of bringing the eight cables up the terminal pole, requiring four pipes or protecting troughs and a cumbersome paralleling bus arrangement on the pole top. To overcome this the "Pillar Box" has been designed. This box is supported on two concrete piers going down below frost line, the box being secured by a pair of anchor bolts embedded in the concrete. The standard box is what is known as a ten stub box, terminals being provided for ten outgoing leads on both positive and negative sides of the system. Each polarity is kept separate with a removable asbestos board barrier intervening. This design makes it easy to work without danger of short circuit and provides a quick and easy means of testing and sectionalizing without necessity of going up the pole or opening subway boxes, the latter being a tedious and unpleasant task in winter weather with everything below ground covered with a layer of snow and ice. Fig. 9 shows the method of connecting one of these pillar boxes for an intersection, such as shown in Fig. 6, the box being preferably located on the curb line of the main street. Fig. 10 shows a similar box connected for an intersection on which underground supply is used on both the main and intersecting streets. In this application the feeder line is carried over the intersecting street to the point where transformers are located overhead; or if an extensive system is maintained, the transformer may be in an adjacent vault and the high tension supply cable laid underground from the nearest pole terminal, where high tension fuses are located. This type of construction does away with all necessity of getting to the transformer vault for fusing or disconnecting and forms an ideal method of distribution for a fairly large city, particularly if a common neutral primary supply system is maintained. With such a system a small single conduc-

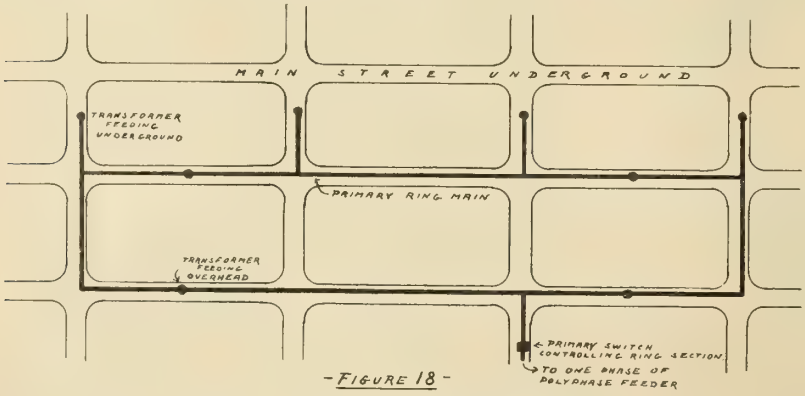
tor primary cable is all that is necessary. Fig. 11 shows a section and plan view of such an arrangement.

The cost of these pillar boxes complete, with hot galvanized finish throughout, is about $100 each, or approximately the cost of trying to get the entire bunch of cables up the terminal pole.

In the case of long or important business blocks it is often desirable to be able to further sectionalize a main in the event of trouble. This is readily accomplished by running in what is known to us as a "loop service" and consists of simply cutting the main and carrying both ends into the building and connecting same at the service entrance through a loop box. The service wires are then, of course, the full size of the main. In general the loops are located in the more important buildings and not only furnish a ready means of sectionalizing, but allow of this important customer being supplied from either end of the loop while locating and repairing a fault. Fig. 12 shows the method of looping.

The details of terminal and transformer pole arrangement for the system should have careful consideration, as they form the heart of the entire net work. Cables must be provided with weatherproof terminal bells or "potheads" and fuses are necessary unless the cables lead directly to a pillar box. The transformer should not be located on the cable pole, but on the next pole on the line, in order that linemen may not be called upon to handle a "death trap" caused by high tension apparatus being located on a pole which is "grounded." The general arrangement is shown in Fig. 14, and details of cables and "terminal bells" in Figs. 16 and 17. The latter is a "loop" terminal and would apply to the extreme ends of a main street, where the two mains, in place of entering a pillar box, are carried up the pole.

With a system of this kind all power demands must be met with single phase motors, which usually is not difficult owing to individual motors in the business section seldom being of large size. The principal objection to motors of this type usually comes from the customer, owing to their higher cost as compared to multiphase type. If it should be necessary to meet this situation the supply company can well afford to pay the difference rather than yield to the demand for polyphase supply on which the excess investment for mains, services and meters, will be considerably in excess of the difference in the cost of the two types of motors.

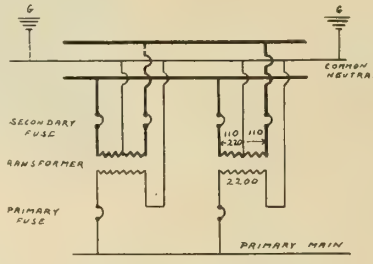


- FIGURE 18 -

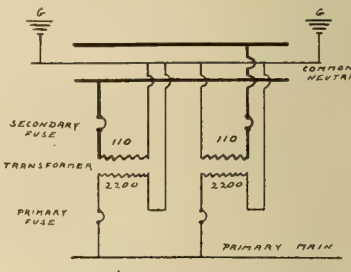
Several systems of polyphase underground supply have been tried out, but, in the writer's opinion are objectionable. One of these is the four-wire system, giving 115 volts from each of the three insulated phase wires and the common neutral, and approximately 200 volts across phases. This system requires a motor voltage which is not standardized and requires balancing in three sections in place of two with the ordinary three-wire single phase system. Copper cost is also higher than with single phase.

The other system is a straight three phase 550 volt delta on which dry type single phase transformers must be installed on the customers' premises for stepping down the power voltage for lighting. The use of such a system is a twenty years step backwards. The cost of transformers alone will offset any possible saving in copper, to say nothing of core losses and added fire risk to the customer's premises.

In conclusion we would call attention to the desirability of having the primary supply for the suggested underground syste marranged as a ring main. The secondary, to get full advantage of diversity factor and consequent low copper and transformer costs, must be interconnected. With a single line primary a break in the line will cause considerable trouble in the low tension network, owing to the transformers on live side of break not only feeding their own load but supplying step down current which will go through the intervening mains an dstep up again in an attempt to supply the load beyond the break. This primary ring may be arranged as shown in Fig. 18; or may be a ring encircling the underground section, in which case the pillar boxes may be dispensed with and loops carried up on intersecting streets on both sides of the main street. With moderate loads this will involve using motor transformers of smaller sizes, with corresponding increased cost. If, however, the load at each intersection is in excess of 15 kw. then the additional cost will not be appreciable. This is due to the fact that a 15 kw. transformer is about as large as one can safely use as a unit on general distribution, so that for heavy loads two transformers at each intersection would probably be required. In this case it makes little difference whether they are on the same side or opposite sides of the main street. Just a word of warning, however. If you require two transformers to feed into the same point don't connect them in multiple, as in Fig. 20. If you do, don't be surprised when they both drop their load at the same time, which they will ninety-nine times out of a hundred. Connect them one to each side of the three wire system, as in Fig. 21, and let each take care of its own part of the network.



IMPROPER METHOD OF BANKING A PAIR OF TRANSFORMERS.
- FIGURE 20 -



PROPER METHOD OF BANKING A PAIR OF TRANSFORMERS.
- FIGURE 21 -

Personals

Mr. C. A. Howe is spending a few weeks in Eastern Canada in connection with the business of his company.

Mr. S. L. B. Lines, president and managing director the Chamberlain & Hookham Meter Company, Limited, is on a six weeks business trip to England.

Mr. N. E. Bell, who was formerly electric wiring inspector for the Ottawa Fire Insurance Underwriters has been appointed to a similar position by the Ottawa city council.

The Care of Graphic Meters

A Practical Article on their General Use, Testing and Repair

By Mr. G. D. Gratton*

What is a Graphic Meter? As understood by the electrical profession, it is an electrical measuring instrument which indicates the condition of the circuits, and arranged that this condition may be drawn or traced on a chart by means of a pen or other marking device connected with the measuring element, thereby making a graphic representation of the condition of the circuit. The chart is marked or scaled to represent the value of units of which it is desired to make a record, and is also marked to show the time of the day, in order that the condition which existed in the circuit at any previous time can be ascertained. The chart is caused to move under the printing or pen mechanism by means of clockwork.

There appear to be several different titles for denoting Graphic meters, such as Graphic Curve-Drawing Meter, Graphic Recording Meter and Graphic Meter. Just which is the most correct title seems to be largely a matter of choice. The writer believes that the title Graphic Meter, which is the shortest, is also as expressive as any, for the reason that when the word "Graphic" is used it is understood that a Graphic meter is meant and not an Indicating or Integrating meter.

General Principles and Selection of Meters

The principles of the measuring elements of graphic meters are the same as those used for switchboard indicating and portable instruments, as follows:

The Kelvin Balance, the Siemens Dynamometer, the Moving Iron, the Induction, and the D'Arsonval. The most common are the Kelvin Balance and the Siemens Dynamometer, which are generally used for alternating-current voltmeters, ammeters and wattmeters, and in some makes for d.c. voltmeters. The dynamometer, moving iron and induction principles are used in various makes for voltmeters, ammeters, power factor, and frequency meters.

Graphic meters may also be said to be of two types, that is, the relay type and the direct-acting type. In the relay type the measuring element does not do the work of operating the pen, but closes a set of auxiliary contacts which close the circuit through the relay coils, or solenoids, that operate the pen. This keeps the pen friction, etc., away from the measuring element, and tends towards greater and longer accuracy, due to lighter moving elements; also the instruments do not require so much power to operate, that is, the shunt losses will be much less, as the instrument does not require as great a torque to operate the pen. It also means considerable saving in transformer capacity to operate the instrument.

In the direct-acting type the measuring element operates the pen directly on the chart, so that the moving coils are obliged to have a large torque in order to overcome the pen friction, etc. This means high shunt losses, and in some makes a heavy moving element. In one make of graphic with a high torque, the moving element weighs over half a pound, and the makers claim that this is done in order to give sufficient damping to the moving element. It was found, however, that unless the instrument is cery carefully adjusted, the pen did not follow the fluctuations of a fairly steady load, and on a fluctuating load did not follow the extreme variations in the load, but gave a good average curve of the load. This would be an objectionable feature in some cases and in others all that could be desired.

One well-known make of graphic meter of the direct-acting type, the potential or shunt coils require 100 watts each. In the case of a poly-phase wattmeter this would mean a shunt loss of 200 watts. This is a very high shunt loss compared to another well-known make operating on the relay principle, the shunt loss of which is about 8 watts and the power required by the solenoids or relay coils 25 watts, making a total watt loss for a polyphase meter of 41 watts.

The selection of a graphic depends on several conditions, such as the nature of the load, the terms of the contract, and the accuracy by which the load must be measured. If the charges are based on the indications or readings of the graphic, then one should be chosen that has good accuracy and that will remain accurate, even if it is the most expensive. On the other hand, if the graphic is merely intended to show the nature of the load, or to indicate when a peak or contracted load has been exceeded, an instrument that is not so accurate, and probably cheaper, may be used.

Paper or Chart Speed

The speed at which the paper shall travel is determined by the character of the load to be measured and the duration of the peak. This refers more particularly to wattmeters. For instance, a lighting load with a slowly rising and falling peak and generally a peak of rather a long period, a slow paper speed may be used, say 1 in. per hour, with good results. For another example, take a power load consisting principally of mill machinery on which the load is intermittent, such as rock crushers, air compressors, pulp grinders, conveyors, etc. In this case the load will be of a fluctuating nature and the peaks of short duration and will likely occur quite frequently. If a slow speed chart is used a broad line will be traced, due to the fact that the lines made by the pen will overlap, and the centre of the line will have to be taken as representing the peak. On the other hand, if a high speed paper is used the curve will be extended or drawn out and the intervals between the peaks plainly distinguished. If in this instance the contract peak was 10 minutes, it would be better to use the slow speed chart, and again, if the same load was contracted for on a one-minute peak it would be necessary to use a high speed chart in order that the cruve would not be crowded and the peaks overlap. It would be a difficult thing to measure a one-minute peak on a chart having a speed of one inch per hour, as, in most cases, the thickness of the line drawn by the pen would represent a time interval of more than a minute when scaled or measured on the chart, while the actual peak might have been less than a minute. For a one-minute peak a chart speed of not less than four inches per hour should be used. In general, a chart speed of 1½ or 2 in. per hour will suit the majority of cases, and will allow a peak of short duration (not less than five minutes) to be scaled off the chart with accuracy.

Another point that should be borne in mind is whether it is desired to know the extreme variations or momentary peaks of the load, or the average load. This refers to such loads as motor driven air compressor with rapid unloader, mine hoists and other intermittent loads. On a load of this nature a curve traced by a meter with little damping would be rather broad and uneven, depending, of course, on variations in the load. On the other hand, a meter in which the damping could be made very heavy would not follow the momentary fluctuations, but at the same time if the peak continued it would indicate the maximum.

A meter that uses a fairly wide chart, say 5 in. or more, is better adapted to close and accurate reading than one using a narrow chart. Especially is this so in the case of high capacity wattmeters and ammeters. The thickness of the line drawn by some pens may represent a value of 100 kw. or even 500 kw., and the line would have to be very carefully scaled in order that the company may not either over or under bill the customer.

*Presented before the C.E.A. Convention.

Scale Capacity

In choosing the scale capacity of a graphic meter it should be so chosen that with the average working position of the pointer or pen it will be at least half way across or over the chart. This tends to better accuracy in reading, and in the case of an alternating current wattmeter this would allow it to operate on a load with a low power factor without overloading the current windings and still keep the pointer well up on the scale; for instance, a 200 kw. load is to be measured, the power factor being probably about 75 or 80 per cent. An instrument with a scale capacity of 400 kw. would be chosen, allowing for small increased load and the low power factor. This is quite an important consideration. It is a big mistake to set up any instrument that has a large scale capacity and operated so that the pointer does not move very far from the zero point, for the reason that no measuring instrument is accurate when used so that the pointer is not deflected more than a quarter of full scale value (none of the manufacturers will guarantee their instruments when used below this value); at the same time they should not be operated at more than three-quarters or four-fifths of full scale value for the same reasons as above. In the case of wattmeters there is another point to be taken into consideration, that is, the power factor of the circuit. For instance, an instrument whose full scale value is 400 kw. is operating on a circuit which requires 300 kw. at 75 per cent. power factor. In this case the pointer would be operating at three quarters of full scale value, but the current coils would be operating at full current value. If the load increased to 400 kw. at the same power factor the current coils would be overloaded, which would tend to cause an incorrect reading. Also if the instrument is operating from the secondaries of current transformers, there would be another error due to the transformers being overloaded, as nearly all a.c. instruments are operated from secondaries of either or both current and potential transformers. It is the best practice to select transformers suitable for the present load, allowing for 50 per cent. or even 100 per cent. increase in load, and when that value has been reached change the transformers for larger ones. As it is only the current transformers that will have to be changed it will not be a very expensive operation. There are, of course, circumstances and conditions which would not allow of this, so that transformers large enough for the maximum capacity would have to be installed in the first place. When this is done it will necessitate changing the value of the scale. This is not a complicated operation, and if it cannot be done by the man in charge of the meters it can be sent to the manufacturers. The chart will also have to be given a new value to agree with the new scale. All that is necessary is to send a sample of the old chart with the new values marked on it to one of the printers that do this kind of printing. There are several in the field. With one or two exceptions the company with which the writer is connected uses all 5 ampere, 100 volt, graphic wattmeters having a full scale value of 1 kw., and has the charts printed to suit the transformers with which the meter is used, making our own scales and samples of the chart for the printer to work from, or if we do not want to have a special chart printed we use a chart having a value of 1 kw., and multiply the readings by the ratio of the transformers.

Performance

For satisfactory performance or operation, graphic meters require more careful attention than probably any other kind of instrument in regular daily use, for the reason that there are more details to get out of order, and as the interior is generally easily got at, it is as easily damaged by Mr. Paul Pry. This and carelessness is the cause of most of the trouble with graphic meters, and it is very doubtful even if very careful instructions were given the operators in charge of the switchboard or station that the trouble would be very greatly reduced. From the writer's experience the majority of operators do not remember verbal instructions for longer than it takes to tell them, and seldom look at printed instructions. It is by far the better plan to let one man look after the graphic meters, even if these is only one meter on the system. He will become well acquainted with the instruments in time and know how to handle them, doing better and quicker work and the instruments will give better satisfaction than when every Tom, Dick and Harry has a crack at it.

Repairs and Maintenance

This requires a good deal of skill and patience. As a large portion of the work is light and delicate, it should not be attempted by anyone who has not had previous experience in light repair work. The person undertaking this work should also be a pretty fair mechanic and know what the various parts are for and not be guesing at it; in short he should thoroughly understand the principles of the instrument he intends to repair. This also applies to other instruments than graphic meters. The question of how much repair work should be done on the job and what should be sent to the shop can only be answered by local conditions. If a company has a considerable number of instruments in service it is by far the better method to keep one or more spare meters on hand so that in case an instrument breaks down on an important customer it can be changed. This will save a loss or interruption in charts, and what is more important, a probable loss in revenue, due to a peak not being recorded. This same peak might very easily pay the cost of the extra graphic. In addition to the extra instrument a spare clock and several of the parts that are likely to require renewing should be kept on hand so that repairs can be quickly made. Generally speaking, only the smaller kind of repairs should be made on the job, such as replacing jewels, pivots, suspension wires, winding contacts, cleaning penpoints, etc. It will be found cheaper in most cases, where it is necessary to repair the clocks, to change them and do the repairing in the shop. Also in cases where it is necessary to do any recalibrating due to burn-outs to the leading-in springs, resistances, etc., it is better to remove the instruments and do the work in the shop. It is a hard job at the best to calibrate a graphic meter on its load, as the load is almost certain to be more or less variable, and even if a temporary load is rigged up it would have to be regulated in some manner, and it will take a good deal longer to do the job, and it will probably not be as good a job, as if done in the shop where everything is convenient. It will nearly always be the cheapest, even if it does mean an extra trip to reinstall the instruments, to repair it at the shop. An argument that might be used against this is that the calibration might become changed in shipment. This is almost entirely a question of packing. The writer has calibrated and shipped graphic meters without the slightest change in calibration. At the same time he has seen instruments seriously injured through careless packing.

Cost of Repairs

This is an item that should be given plenty of consideration. It is very poor policy to buy a graphic that, while the first cost is low, is all the time in need of repair. This does not necessarily mean replacing broken parts but may mean frequent checking, resetting zero, repairing the rewinding apparatus for the used chart, cleaning relay contact points, etc. With this company the largest item in the cost of repairs is the labor. With some companies transportation is a large item. The cost of actual new repair parts is not very great, the largest item in this case being new pens. As stated above the largest item in the cost of repairs is labor. In a way this may not be strictly true, as with some

companies the largest portion of this item is the time it takes to get to and from the job, for the reason that some of their customers, substations or power houses are some distance away from headquarters. So far as the time to do the actual work of repairs is concerned, it is not a large item, being from 1½ to 5 hours. The average time might be placed at 2 hours. As stated above, any job that is likely to prove a big one is sent to the shop and in this case the labor or time may be anything from one-half to several days.

The cost of doing various kinds of repairs, as found by the writer, is given in the following list:—

Cost of Repairs—Labor Only

Hand-wound Clocks	$1.60 to $4.00
	Average $2.00
Motor-wound Clocks	$0.75 to $3.50
	Average $2.00
Clock Motor	$2.00
Paper Mechanism	$2.00 to $6.50
Replacing Pivot	$1.80
Repairs to Pen	$1.00 to $2.00
	Average $1.80
Dotting Mechanism	$1.50 to $4.00
	Average $2.00
Pen-lifting Mechanism	$1.50
Pen Shaft Bearings	$1.00
Cleaning Jewels and Contact Points	$2.00
Repairing Resistances	$5.00
Repairing Control Circuit	$2.00

The most common of the troubles which may be looked for and their remedies are given below:—

Stoppage of Hand-wound Clock—This is generally due to the clock getting dirty and sticking, and as a general rule they may be cleaned by washing thoroughly with gasoline or benzine with a small, long-bristle paint brush. After washing, oil thoroughly with watch oil. Nye's watch oil is very good for this work. Some makes of hand-wound clocks will stop if wound too tight, as the springs seem to bind instead of unwinding. Remedy: Remove the escapement and start the clock unwinding, being careful not to let it unwind too fast.

The stoppage of motor-wound clocks may be due to several reasons, the chief of which are broken winding contact, winding dogs, and the pin in the main-spring shaft that moves the winding dog. The only way to satisfactorily repair these is to put in new parts, as they are not expensive.

Zero Shift—By this is meant the shifting of the pen from the zero line. This company has found this to be a common occurrence in one make of graphic meter. It may be due to several causes—change of temperature, shifting of control springs, violent overloads or surges, misplaced pen or chart, friction, etc. In some cases where the temperature effects are noticed, it is due to the fact that the instrument is located in either a hot or cold place, such as a substation with no means of heating in the winter time, or in the hot weather poor ventilation. This is almost certain to cause a change in the tension of the controlling springs. The only remedy is to adjust the springs to suit the temperature each time there is a considerable change. It goes without saying that a meter of this kind should not be on a load that it is desired to measure with any degree of accuracy. In the case of the relay type of meter, this trouble very rarely develops, and as there is always provided a mechanical means of correcting it, it is very little trouble to do so.

If the control springs have shifted they will probably be found loose. Move them till the pointer comes to zero, and tighten.

If a violent overload has been the cause of it, the pen shaft will probably be found bent. Straighten shaft until the pen comes to zero.

Misplaced pen and chart can easily be detected by an examination, and is as easily fixed.

Friction may be caused by broken jewels, pivots, pen bearing too heavily on chart (this applies principally to the direct-acting type), in one type the suspension wire may have stretched or moved and the moving element be rubbing on the lower jewel.

Meter Does Not Register the Correct Amount of Energy Passing in the Circuit—This may be due to several reasons—improper connections, blows fuses, grounds on the secondary of the current transformers, burnt-out or open-circuited potential coils, burnt-out or open-circuited resistances in series with the potential coils. The best way to locate the trouble is to start by testing with a lamp to see if the potential is on. If this is found off, the fuses are burnt out. Replace with new. If the potential is found to be on, try disconnecting the potential leads to the meter and see if there is a spark when the lead is touched to the meter terminal. If there is no spark, the potential coil is almost certain to be burnt out (and whether this will have to be shipped to the manufacturers or repaired by the company depends on the ability of the repairman). If there is a spark, the potential coil is O.K., and the trouble will most probably be improper connections. Trace the connections and reconnect if necessary. If the connections are O.K., look for a ground on the secondary of the current coils or wiring. The effect of a ground on the current wiring is to shunt the current transformer and cause the meter to read low. This is especially so in the case of polyphase circuits where two or more current coils are used.

There are numerous other causes of trouble and their remedies, but it would require too much space to mention them here.

Cost of Operation

This is the cost of repairs, testing, charts, current losses in potential and control circuits, ink, etc. As to which is the largest item depends on local conditions, though, generally speaking, it is the cost of repairs and testing that will be noticed by the management and considered as the largest item, even though the largest cost may easily be the cost of the current required to operate the instruments. Consider the case of a polyphase instrument that requires 200 watts in the potential circuit; this loss goes on every hour, year in and year out, and with energy costing 1c a kw. hour, means a loss of $16.50 a year, and in a station, or a number of stations, where a large number are used, this loss amounts to a considerable amount, and is worth considering. The cost of testing depends on how often the instrument is tested and the cost of transportation. The same applies to the cost of repairs. With our company the largest part of this item is transportation and the time getting to and from the job.

The cost of charts varies with the kind and style used and the quantities ordered. The cheapest way to get the charts is to buy a year's supply for all the graphics in use. By doing this a much better figure can be obtained than by purchasing a few at a time.

Testing

A large chapter could be devoted to this subject and then it would not be any too fully covered, but the writer will only make a few general remarks, relating chiefly to wattmeters, of which there are more in use than probably all the other meters together. The following remarks apply to polyphase instruments.

Shop Testing

A convenient rack should be made up, on which a graphic meter can be quickly hung. This company uses a hardwood board arranged on the front end of its service meter testing table, and drilled so that any make of graphic meter can be mounted in a few minutes, and the terminals, connections,

etc., are easily gotten at for repairs and recalibration. The board itself is fastened to the testing table by means of straps and bolts with thumb screws, so as to be easily removed or set up. The testing table itself, is made of heavy dry pine, well shellacked and varnished. The current supply is 3-phase, 3-wire, 100 volts, 60-cycle, supplied from a bank of 10 kw. transformers and 150 volt, direct current supplied by a 6 kw. motor-generator set. The table is so arranged that it can be used as two independent boards for single phase work, or can be combined for 3-phase work. Any power factor from zero lagging to zero leading can be obtained. From the diagram of connections, shown herewith, it would appear to be rather complicated, also there is the possibility of making dead short circuits. As a matter of fact, in actual operation, the board is very simple, and if a short is made it does no harm, as the board is protected by circuit breakers which are very effective. These have operated time and again on a short when a lamp fuse did blow. In addition to this the standards are protected by a switch

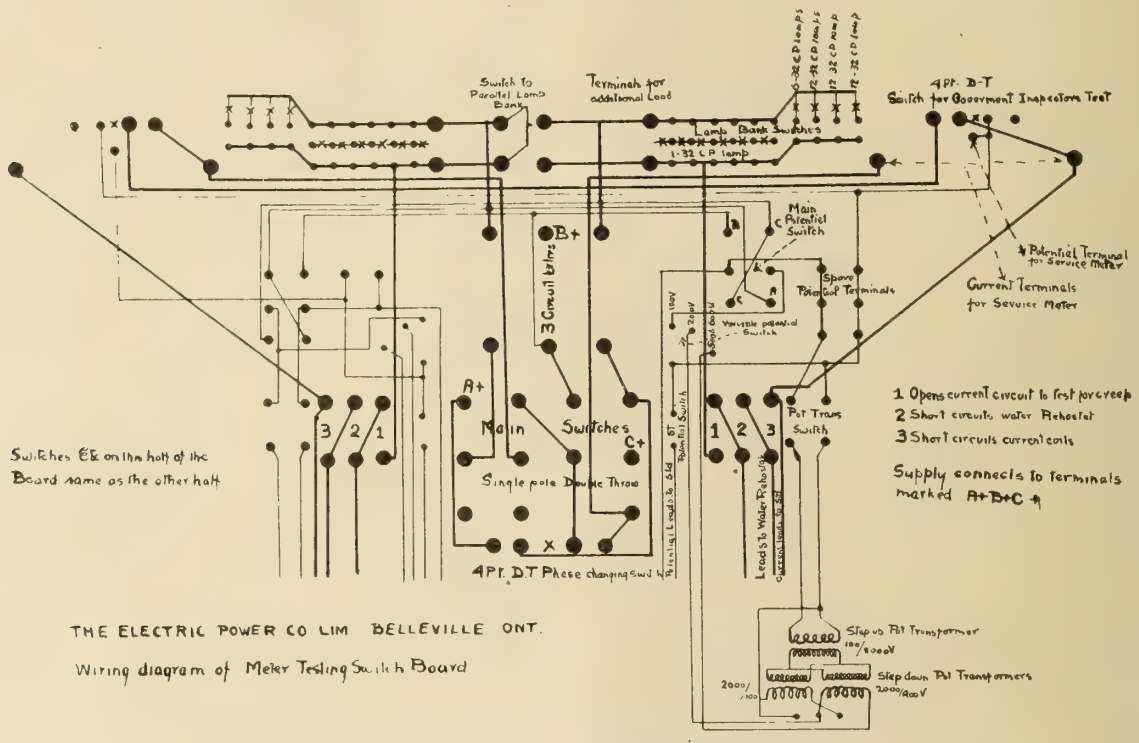


Diagram of Connections—Meter Table for Testing in Service

that short-circuits the current winding, making it impossible to do any serious damage. No testing table of any description should be without circuit breakers, as they are the very best of protection. It would take too much space here to describe the testing table in detail, so that the brief description given will have to suffice, any more than to say that it was designed expressly for quick and accurate testing of single and polyphase watt-hour meters, and, of course, can be used for testing any other kind of meter.

Every graphic, when received from the factory, should be tested, for accuracy of scale indications, correctness of chart ruling, balance between elements, and thoroughly examined for defects of any kind. To test for scale accuracy, connect in series one element at a time with a standard indicating wattmeter on a single phase circuit. The indications of the standard wattmeter, multiplied by the ratio of the transformers with which it is intended to use the graphic, should equal the graphic reading if it is correct. If no transformers are to be used, then the indication of the standard should be the same as the graphic; make a note of the errors, if any, and then test the other element. If there is no difference between the readings of each element, then they are equally balanced. If the difference is very great, it should be corrected by either adding a little more resistance to the resistance in series with the potential circuit that reads the highest, or taking a little away from the low reading element. Which of the two adjustments should be made depends on whether the high or low reading is correct; if the high reading is correct, then the adjustment should be made on the low reading element; if the reverse is the case, then adjust the high reading element; if both elements are high, then both will have to be adjusted by adding more resistance. It should also be tested on zero power factor if possible, but as it is very easy to get a 50 per cent. power factor on a 3-phase testing circuit, it will generally be more convenient to test at 50 per cent. power factor, and if the graphic is found correct at 50 per cent., it will be correct at zero power factor or vice versa. It is **very important** that a polyphase wattmeter should be correct on power factor, and it is equally so that they should be correctly balanced. It is not enough to think that if one element is a little low and the other just as much high, that the average error will be zero. This would be the case if the power factor of the load were 100 per cent., but as this is never the case on a power load or even a lighting load, there will be an error depending upon the power factor.

It should also be pointed out that both potential circuits should be connected in parallel when making these tests, the same as is done in testing watt-hour meters, for the reason that in some makes of graphics one element affects the other, while in other makes there is no interference between elements, so that it is the safest to connect both potential circuits. Care should also be taken to see that the current is passing through the windings in the proper direction, otherwise there will probably be an error that would not exist if the instruments were properly connected.

Another method of testing the balance between elements is to buck them; that is, connect one element to read backwards, but this is not as satisfactory as testing each element separately, for the reason that the pointer may come to zero and yet the elements are not balanced, as would be the case if one element was exactly as much too low as the other is too high.

The charts should be examined to see that the ruling is correct as to the spacing, etc. If not correctly ruled there will be an error in taking the reading off the chart.

The meter should be very carefully examined for mechanical defects, such as loose connections, improperly adjusted clocks, winding attachments, re-rolling and paper mechanism. If none of these troubles can be seen the instrument is in apparently good shape. However, it is a good plan to set it up and let it run for several days in order to bring out any defects that exist.

This generally consists of comparing the readings of the graphic with a portable standard, and noting the error. The test is generally made by connecting the standard in service with the instrument to be tested, on the same load, using the same instrument transformers when they are used, which is generally the case, though in some cases it is necessary to use a separate set of portable testing transformers. This is only done if there is any reason to doubt the accuracy of transformers to which the graphic is connected. It is much more convenient to use the same transformers. If it is desired to test the instrument as a secondary meter on an artificial load, the switch board lights may be used or a portable lamp bank.

A few words might be said about the method of connecting the standard in series with the meter under test, particularly when using the same current transformers. Until quite recently very few power boards were equipped with any kind of means for testing, and the tester had to do the best he could to connect in, and frequently got a shock for his trouble. It is warm work and dangerous, to connect in series with the secondary of a current transformer, as a slip may mean a violent shock and injury to the instrument and transformers. In addition to this, everything else is alive, and it is a very awkward proposition to wear rubber gloves, as the wires, terminals, etc., are small. The writer has seen several accidents of this kind. In one case three instruments were damaged, and the tester's hand severely burnt. Very few current transformers are provided with suitable or convenient means of short-circuiting them if necessary. One manufacturer provides a piece of solid copper wire, which always breaks after it has been used a few times, and in this particular make the secondary terminals are so located that it is often impossible to get at them after the switchboard has been put in operation. It would be very much appreciated by those who do the testing, and the trade in general, if the manufacturers of current transformers would equip them with a small knife or plug switch for short-circuiting them, as there is hardly a switchboard in operation that the meters do not have to be tested, etc., at some time. All of the switchboards being erected by our company are provided with testing plugs, which, when supplied with the board when new, add very little to the initial cost, which is very easily saved in the time saved to make the connections to test, over the old method. Our company is also equipping all of its power boards with test plugs that were not so equipped originally. The cost of doing this will very quickly be saved in the time saved making the connections and test, and, aside from this, the safety and convenience is very much increased.

The following points should be taken into consideration when deciding to purchase a graphic wattmeter.

1st.—The size of the contracted load and the possibility of a quick increase.

2nd.—The kind of load, whether steady or intermittent.

3rd.—The power factor of the load.

4th.—The length of the contract peak, and its relation to the actual peak. This is in order to determine the correct chart speed.

5th.—It is desired to know the maximum fluctuations of load or the average?

Records

A system of records, either cards or loose-leaf system, should be kept of all the work done on the instruments. This will prove invaluable, for a reference as to what repairs have been done, when tested, cost, etc.

In conclusion, would say that from this company's experience, we have not found the best any too good, as there is not yet a perfect graphic on the market. There is room for improvement in some detail or other.

One fact that is very noticeable is the lack of information regarding this class of switchboard indicating instruments as regards repairs and recalibration. With the exception of the manufacturers' bulletins there is practically nothing to be had. A good book on this kind of work would be very much appreciated by meter men especially, and the profession in general.

This article should not be taken as covering all the points and details of graphic meters, but more as a review of the experience and methods followed by the company with which the writer is connected.

Electric Vehicles an Ideal Load

The Electric as a Revenue Producer—Coast Cities Waging Vigorous Campaign

By Mr. C. Rummel

It is the general policy of our Company to leave the selling of appliances and current-consuming devices as much as possible to local dealers and agencies. This policy is based on the idea that our business is primarily that of a central station and that we should enter into the actual sale of current-consuming devices only when the local dealers and agents fail to push the sale of any particular branch as vigorously as the conditions warrant.

In the field of electrical vehicles the company found that there were a number of agencies within our territory, the same firms offering both gasoline and electric vehicles. These firms sold quite a few pleasure cars of the electric type but apparently made very little effort to introduce electric vehicles of the commercial type. It was found that when these dealers, being representatives of both electric and gasoline cars, came to a probable customer, the "prospect" generally knew considerable about gasoline cars but very little about electrics. The agent would tell him that he represented both electric and gasoline cars and would put forward the advantages of the type which the "prospect" preferred. This method of doing business was rather a detriment to the introduction of electric vehicles within our territory. To me it seems rather a mistake on the part of the manufacturers of electric vehicles to act through these combination agencies. The agent is, of course, after the dollars and cents and will naturally interest himself chiefly in the article which he can sell in the easiest way and to the greatest number. I have been told by a factory representative that the manufacturers do not care very much in the case of truck sales, their object being to have agencies sell pleasure cars, and that the field for electric vehicles of this type is so limited that it is impossible for one firm to handle the exclusive agency. The manufacturer noted has doubtless come to this conclusion after a thorough trial and we must take his statement as warranted.

As far as Vancouver is concerned, our company found that the practice of selling through combination agents did not result satisfactorily to our interests in connection with the sale of electric cars of the commercial type.

As a result of the above condition the company this year decided to take out an agency, enter the selling field and

*Presented before the C.E.A. Convention.

make a genuine effort to introduce electric commercial cars within its territory.

The first attempt to sell electric cars in Vancouver was made some seven years ago when a five-ton Studebaker truck was purchased by a local firm. There was at that time no proper electric garage or adequate arrangement for charging batteries of electric trucks, nor was the proper usage of the truck understood. Hence the car suffered considerably because of lack of facilities and ignorance as to the proper method of caring for it, this being especially noticeable on the point of overloading. However, in spite of these handicaps, this five-ton truck is in use to-day and doing good work.

In connection with its own work, our company purchased three electric trucks last fall, these being the only sales of electric trucks made at that time by local agents. These vehicles were used as a meter wagon, an arc lamp wagon and a line wagon, and did satisfactory work through a severe winter during which there was a heavy snow fall such as had not previously prevailed in this country for fifteen years.

On the basis of this good showing made by the few electric trucks in Vancouver, the company felt that vigorous efforts should be made to introduce this type of vehicle, although still preferring to leave the matter in the hands of the agents providing the business was properly pushed and adequate garages and facilities for caring for the vehicles would be provided. Upon canvassing the agents it was found that they preferred to have nothing to do with the garaging of trucks but preferred to confine their business in the electric line to pleasure vehicles only. The company then decided to take up the agency for commercial cars as previously noted.

At the very outset the company engaged an electric vehicle expert of eleven years' practical experience, both in selling and garaging. This man was given the advantage of extensive advertising in the daily press, thus thoroughly acquainting merchants with the advantages of electric trucks as well as the entrance of the company into the business. The salesman began his campaign among the wholesale men on February 15th, and has since been conducting an active canvass by personal visitation, follow-up letters, pages in the monthly motor magazines, etc. One very effective method followed was to offer the service of one of the company's trucks to reliable "prospects" for an ordinary day's delivery of the firm. Such an illustration proved conclusively the value of the truck to the merchant's business.

Since our salesman took hold of the work, sales of electric trucks have been made as follows: A two-ton truck to a wholesale fruit merchant, a two-ton truck to a wholesale hardware firm, and a one-ton truck for an hotel bus.

During the period the company has also found use for two two-ton trucks which have replaced a gasoline truck and a horse-drawn wagon and a business electric for the light and power department. The two-ton truck for the fruit merchant was placed on the streets last week and has so far given perfect satisfaction. The company's new trucks are also working satisfactorily and the hotel bus will be placed in operation about June 1st.

In addition to the company's orders, there have been sold to Vancouver firms through outside agents a two-ton truck of the electric type to a milling firm and a 750 lb. delivery rig to a local fish concern.

Our electric vehicle representative reports that his "prospects" are many, and every merchant to whom he has explained the electric trucks, even milkmen who have a house to house delivery, are interested.

In carrying out its business as an agent for electric vehicles the company generally orders the chassis only from the factory, the bodies and tops being built in the city to suit the purchaser. This plan is necessary from the standpoint of economy owing to the duty which must be paid on our cars from the States. It is also found that each customer has his own ideas as to style, dimensions, etc., of the top and body, and, if this work is done locally, closer supervision can be given to each part by the purchaser and he is better satisfied with the result.

Early in the campaign for the introduction of electric trucks the company found that there was a necessity for a proper garage for this type of vehicle. To meet this condition and cover the care of the company's trucks as well as those of our customers who did not desire to install their own charging outfits, it was decided to arrange for a garage in the central part of the city. This is now being built, and will provide 110 x 94 feet of floor space and a charging outfit consisting of a motor generating set of 45 kw. capacity. In the garage will be located offices for the superintendent and mechanic, battery room, store room for spare parts, tires, etc.

Before plans were finally made for the company's garage a meeting of all the dealers in the city interested in the sale of electric trucks was held. At this conference the electric vehicle question was discussed in all its phases, various types of batteries, their behaviour, their troubles and other points of interest being thoroughly considered, the meeting thus being most helpful to all in attendance.

At this meeting the charges which the company proposed to make for caring for electric vehicles of the commercial type at its garage was outlined and an agreement reached with the dealers on this point. These charges, which cover all types of battery, were as follows:—

Capacity of Truck	Garage Charges Per Month
750 lbs.	$45.00
1000 "	45.00
2000 "	55.00
4000 "	60.00
7000 "	65.00
10000 "	70.00

These garage charges cover the supply of current necessary for the operation of the vehicle, charging of the batteries, storage of the vehicle, daily washing and oiling, and the making of minor adjustments. These garage rates being established, our electric vehicle representative was able to quote to his "prospects" with assurance just what the cost of their deliveries by electric truck would be, a most telling argument with the prospective purchaser.

It is not the intention of the company to care for pleasure vehicles in its garage, as this field of work is already receiving the attention of the regular garages. For the storage of a car of this type, current for and charging of batteries, daily washing and oiling, etc., a monthly charge of $30 is made and in some cases the garages deliver and call for the vehicles.

A report has been recently obtained from the provincial authorities covering the number of electric vehicles which are now in use in British Columbia. According to this statement there are 100 pleasure cars and 12 electric trucks now operating within the province.

The field covered by our company comprises as a territory in which electric trucks would be chiefly used, the cities of Vancouver and Victoria. The references made in the preceding paragraphs to our agency for commercial cars, the establishment of garage, etc., refer only to Vancouver, where the head office of the company is located. The notation with reference to electric vehicles, however, applies to the entire province, and a number of these vehicles are operated in and about Victoria. Last year a large milling firm bought a two-ton truck for its Victoria trade and after operating the vehicle for a year was so satisfied with the results that this spring the concern purchased a five-ton truck and a two-ton truck, the latter now being in operation in connection with the firm's business in Vancouver.

In both Vancouver and Victoria a number of the private

garages are equipped with charging outfits for electric vehicles and the company also plans to maintain charging equipment at central points within its territory.

The various reasons why central stations are or ought to be interested in electric vehicles have been talked and written about to such an extent that it would be wasting your time to repeat the many thrashed out and worn phrases. Every central station man knows that if he can conduct an electric garage where he can induce his merchants to come to with their wagons and cart away the juice, that this not only saves the cost of distribution lines but that he has here a load absolutely under his own control in the matter of delivery. The majority of the wagons are charged after 9 or 10 o'clock in the evening, and once in a while a wagon might need boosting during the noon hour. Every central station man I have met admits that where a good vehicle charging business is obtainable there is not a more ideal load from a central station point of view.

Since entering this field I have noticed that the vehicle manufacturers look for the assistance and co-operation of the central station, and I found on my recent trip down the coast that every central station manager is fully alive to the possibilities of this new current-using device. The rates made for current leave no room for competition for either horse or gasoline wagon in respect of cost of operation. If the manufacturer will now fulfil his part and bring the cost of the truck within reach of the average merchant and not only of a prosperous few, the co-operation so attained would be most effective and complete. Our Canadian prices are at present too high. The cost of a five-ton truck f.o.b. Vancouver is about $7,500, a first investment which is beyond the means of the average merchant. The "Ford" people here are selling a 750 lb. gasoline delivery rig for about $800. The electric 750 lb. delivery wagon laid down in this city costs in the neighborhood of $2,500. It must be admitted that in face of this tremendous difference in first cost it requires an excellent salesman to convince a "prospective customer," that in spite of this difference he is making a saving by buying an "Electric." Most of this saving the central station claims is due to the economic operation of the Eleceric, brought about by low rates of current offered by the central station. The next move should therefore be on the part of the manufacturers to produce a vehicle at reasonable cost to the Canadian merchant.

I trust these few remarks will bring out a lively discussion at your meeting, and that the above information will be of value to you in obtaining an idea as to the situation of British Columbia with reference to electric vehicles.

Hydro-Electric Regulations

The New Rules of the Hydro-Commission Compared with the National Code

By Mr. H. F. Strickland*

Most people in the electrical business are more or less familiar with the National Electric Code which has been the standard of electrical installation work both in Canada and the States for some years.

The National Code has been adopted by every municipality in Canada and the States as the basis of their regulations.

The Hydro-electric Power Commission, however, deemed it advisable to investigate the merits of every available practice here and in Europe, in order to satisfy themselves as to the very best rules and regulations obtainable.

In writing or adopting rules and regulations it is a very difficult task to frame them in such a way as to render them sufficiently flexible, and, at the same time practicable; especially is this the case with new regulations, as it is not desirable to introduce drastic changes which might inflict serious loss upon manufacturers and the dealers in electrical supplies.

The National Electric Code has, in conjunction with its Underwriters' Laboratories, kept in close touch with the manufacturers of electrical fittings and material, so that it has been a difficult matter for doubtful or unsatisfactory material to be marketed. The Underwriters' Laboratories in Chicago enjoy an enviable reputation in the United States for absolute fairness, and their approval of materials is accepted without question by all underwriting bodies as well as by all Municipal Electrical Inspection Departments in the States and Canada, and being personally acquainted not only with the personnel of the Laboratories but having thoroughly investigated and had dealings with them continuously for a period of over eight years, I have no hesitation in stating that their reputation is well founded.

The National Electric Code has furnished the bulk of the rules of the new Hydro Regulations now before us, because it has been found after careful consideration that the adoption of such of the Code rules as have been selected is in every way appropriate at the present time.

It will be noticed, however, that the arrangement of the Code is somewhat complicated, and embodies, in a general way, rules covering every conceivable form of wiring, inside and out. There are a lot of recommendations, many "shoulds," frequent repetitions, and an equal or even greater variety of cross references.

In editing the Hydro Regulations the rules have, as far as possible, been put under proper classifications, and very few repetitions or cross references occur.

The general rules as now in the Code are practically unaltered, so that the manufacturers and dealers in electrical supplies will not be adversely affected.

The Hydro Rules contain practically no "shoulds" but are positive in nearly every ruling, which if enforced as intended, should place the electrical inspection work of Ontario in the front row.

Nowhere on this continent is there a State inspection similar to that now proposed, although there are numerous civic inspection systems, many such in the United States and a considerable number in Canada, but in each case they are isolated, and there is more or less difference in the interpretation of the same rules; for instance, the inspection in the city of Winnipeg, which is carried out under the rules of the National Electrical Code, may differ considerably from that in the city of Halifax which has adopted the same rules. This diversity of interpretation makes it a very difficult matter where contractors are called upon to execute work in cities where they have not been accustomed to do business, as compliance with the rules in each separate Inspection Department is often affected by the personality of the Inspectors in such districts.

The Hydro-electric Power Commission's system of inspection promises without reservation to be the very best method which has been devised in any territory of similar magnitude. Under the Power Commission Act, every Municipality in this Province must provide a sufficient and proper number of inspectors to enforce the rules adopted, and, owing to the fact that all disputes as to interpretation must be referred to the Commission for final adjustment, there will be such uniformity as will be not only of advantage to the general public but will, undoubtedly, be a great source of satisfaction to all those engaged in the electrical business.

The Hydro Rules and Regulations, as now before the public, have not been drafted with the idea of covering every

*Presented before the C. E. A. Convention.

conceivable form of construction, large and small, as has been attempted in the National Code.

It is hardly necessary to have a special set of rules governing the installation of such works as large central stations, sub-stations and similar undertakings which are invariably installed under the supervision of competent engineers. Such installations will be treated on their own merits. The set of rules now before us is drafted for the purpose of covering all such general inside wiring as will be met with in every-day practice and which anyone is liable to be called upon to perform. While a large percentage of the rules is an adaptation of the National Electric Code, it has been a very difficult task to re-classify them, and in many cases, reword them in order to avoid the cross-reference and repetitions now so evident in that Code. In addition to this it has been found necessary to introduce a great many new rules and to enlarge many of the Code Rules to make them more comprehensive and complete. I will take a few concrete examples by way of illustration. In the first place, the new Regulations open up with some five pages of preface; this preface explains the nature of the legislation and the interpretation thereof in order to convey to the contractor and others interested such necessary information as will enable them to comprehend the scope of the rules in question and the interpretation which will be placed upon them. This preface takes the place of some short introductory matter now in the Code, which latter is after all but a suggestion. Turning to page five we find a section covering "Switchboards," which contains some five pages of comprehensive rules as against less than one page in the Code, and in addition to this it is necessary to refer to other places in the Code to obtain all the data which affect "Switchboards." On pages eleven and twelve are found rules on transformers, and it is hardly necessary to look elsewhere for rules on this subject, whereas, transformers are alluded to in the Code in some four or five different places. On page twenty-one almost every point in connection with cut-outs, switches and circuit-breakers is to be found under the heading of "Controlling and Protecting Apparatus." The same general classification will be found to occur throughout the book. On page forty-six we come to an entirely new section not found in the Code at all, known as "Services and Service Meters," containing much valuable information and rules covering almost all the most essential features in connection with such work.

As an illustration of the enlargement of some of the Code rules, I would point out that on page forty-eight, reading as follows: "For low potential systems the service wires may be brought into buildings through a single iron conduit, the conduit to be equipped with an approved service head." In the National Code this is all that is said about such work, whereas, by reference to Hydro Rules you will find that this rule is extended throughout the next four or five pages covering practically every detail in connection with such work.

Prominent among the new rules not found in the National Code are those necessary for the protection of life. From some of the finished rules bearing on this feature, I will cite the following: "Under 'Generators' and 'Motors' the grounding of frames is called for where the potential exceeds 300 volts." Similar new introductions are found under "Switchboards" and "Electric Cranes." Under "Installation Work" on page forty-five, such rules as "k" and "l" are intended to reduce danger, neither of which appear in the Code at all. In a word, in various places, rules have been introduced which are calculated to protect unskilled persons and those who are liable to inadvertently come in contact with live parts, from receiving injurious electric shocks. It is, of course, impossible to make any source of energy, attended with danger, absolutely foolproof without placing such restrictions around it that its use would be impracticable and onerous, and the best that can be accomplished is to so reduce such danger that it will be safe to use electricity in its various forms.

Up to the present time there has been no legislation of any kind in this Province bearing upon the introduction or use of electricity, with the result that anyone, skilled or unskilled, could install electrical apparatus in any way be pleased, and so long as the lights burned and the wheels turned, it was regarded by the consumer or purchaser as evidence of a satisfactory job.

It is true that the Fire Underwriters have, through their influence, been able to prevent a good deal of loss, chiefly from fire, but where they have no insurance at stake they are powerless to do anything. Municipalities throughout the Province have been, and are to-day, operating plants with old transformers, with ungrounded secondaries, and we all know that it has caused the loss of many valuable lives. The loss from fire from defective wiring has, undoubtedly, been a serious item, and I am firmly convinced that many of the serious fires throughout small towns of this Province have started from defective wiring. It is a common sight to see such wiring in large hotels and stores throughout this Province which is just inviting disaster. I have been in places where the electric current is never shut off from dusk until daylight, where large stores are left at night with lights burning and all wires alive. It is a common sight to see these wires protected (?) by fuses which would allow the wires themselves to melt before the fuses; to see open fuses in dangerous proximity to highly inflammable material, the bulbs of lamps lying on inflammable goods, draperies pinned to flexible cords in show windows, wires lying on gaspipes in the basements of stores and hotels, old frayed flexible cords hanging around in dangerous proximity to inflammable material and often not protected by fuses, circuits overloaded, five, six and even ten times above the proper limit; bare joints in wooden moulding, loose connections under switch terminals and a multitude of other kindred and dangerous defects.

To the uninitiated mind these defects do not convey any idea of serious consequence, but to those who understand, it is only necessary to mention them to show the need of proper control and supervision of electric wiring and the installation of apparatus.

We do not claim that our book of rules is a finality on this subject but we think that they are the best start which can be made, and they will be revised as circumstances warrant it, and I am sure that it is the Commission's desire and intention to keep thoroughly abreast of the times and keep this book of regulations well in touch with the best current practice, and not only to effect a great improvement in the conditions referred to but to secure the co-operation of all those who are called upon to execute electrical work.

In reading this paper it is not my wish to convey to anyone that the use of electricity is highly dangerous. We in the electrical profession know that electricity is conceded to be the safest illuminant and form of power known, and in concluding I would draw attention to this fact in order that the general public may know that while it is necessary to prescribe rules and regulations it is not intended to prejudice the lay mind against the use of electricity in any form. On the contrary, we all know that under a proper system of inspection and regulation it is the safest and most convenient agent for the purpose.

In conclusion, I would point out that I have endeavored to give an outline of the Hydro Rules in a short space and hope that they will be received favorably by those present who, I trust, will realize that it is a difficult matter to present a thorough and comprehensive digest of the entire situation in a few minutes. If, however, there are any points on which I have failed to touch, I shall be pleased to explain them to the best of my ability.

Central Station Advertising

The Various Methods Classified and their Relative Merits Discussed

By Mr. D. H. McDougall*

A central station company's business can be defined as selling profitably electric service.

Before selecting the best let us first endeavor to classify the various possible methods of advertising.

The methods or mediums of advertising may be divided roughly into two classes:

1. By direct contact with the public.
2. By printed advertisement.

In effective printed advertisements let us borrow two axioms:

1. The advertisement must be read.
2. The advertisement must be true.

In order to make an advertisement attractive enough to be read sometimes the second axiom is stretched nearly to the breaking point, but a company that is in a permanent business cannot afford to forget the saying of Abraham Lincoln, "You can't fool all the people all the time." When the public find that there is anything extravagant about a company's advertisements, they grow suspicious of the company itself, and consequently, the result is apt to be detrimental instead of successful or impressive.

The first division of advertising can be divided into:—

1. Delivering the goods.
2. Courtesy to the public at every point of contact.
3. Direct personal canvass.
4. Periodical visits to consumers to solicit criticism and forestall complaints.
5. Prompt and cheerful attention to complaints of consumers by means of an efficient emergency force.

In considering the question of advertising and the best methods of securing results, we would undoubtedly select the methods classified as Direct.

The printed advertisements of all classes, as we said above, must be true to be successful, and how can they be fruitful if the goods are not delivered, or only partially delivered?

No matter what the printed ads. can say, how long would the consumer remain (if he has the option of changing his service) if every time he has occasion to come in contact with the company, or with an employee of the company, he is met with brusqueness and antagonized?

Every employee of the company is a medium for advertising the company by his or her courtesy and efficiency. Possibly next to the actual delivery of the goods, courtesy is the best method of advertising the company's business.

The direct personal canvass by agents, salesmen or other canvassers should be of next importance in considering methods of advertising. This, of course, depends to a large extent on the efficieny of the company's representative. It also depends, like the printed advertisement, on the truth of his statements.

If a salesman secures a contract on the promise that a service will be installed in 24 hours and by reason of his having overlooked the fact that no standpipe has been erected and the consequent delay is one week before the service is installed, the advertisement secured by the agent is liable to be detrimental, and in the same way if the agent promises service in 24 hours and by reason of the inefficiency of the service order department, or the service department, or any other department of the company, the installation is delayed, the advertisement is a poor one. A poor ad. is worse than none at all.

In the same way every employee, whether telephone operator, complaint clerk, demonstrator, billing clerk, office boy or delivery driver, can advertise the company by accuracy, courtesy and efficiency, probably with better results to the company than any printed advertisement.

The complaint department is one of the most important branches of the business, as it is through this department that the customer probably comes most in contact with the company, and by the treatment and manner in which he is met he forms a large part of his opinion of the company's efficiency. A company should select with greatest care the representatives to handle its complaints, and should look to these representatives for an advertisement of the business.

Having said so much for the means of advertisement classified as Direct, let us turn to the second division, namely, Printed Advertisements.

There are several methods of printed advertising which might be classified in the following order of importance:—

1. Direct advertising, by which is meant a company magazine (or house organ) published monthly, circulars, letters, pamphlets, etc., sent direct to ascertained prospects or others it is desired to interest.
2. Daily newspaper advertisements.
3. Bill board, street car and electric sign advertising.
4. Weekly papers or magazine advertising.
5. Theatre programmes, charity and entertainment programmes, etc.

We have selected as of first importance in the printed advertisements what is known as direct advertising, that is, by means of the house organ, circulars, circular letters, pamphlets, etc., mailed direct to ascertained prospects and others it is desired to interest, because His Majesty's mails are pretty reliable and the company can be reasonable sure the printed matter will arrive at its destination.

We have quoted the axiom in referring to printed matter, that it must be read to be effective, and, of course, this is true of circulars as it is of newspaper advertisements.

By careful composition and selected and tastefully set up matter, a magazine, circular or pamphlet can be made so attractive that it will not only be read, but, if sent out regularly, be looked for. The amount of ignorance, or, shall we say, the lack of knowledge of things electrical displayed by the public is astonishing to the initiated, and the field for the dissemination of primary or rudimentary electrical information is very favorable to the electrical companies. If this field, ready for the sowing, is carefully cultivated and the planting is done with selected seed of a simple and understandable nature, the resulting harvest should be an ample reward for the workers.

Somebody said: "Wisdom is humble because she knows no more," so great care must be taken in all advertising not to show an overbearing or exalted attitude toward those less informed.

By means of attractive literature that will be read, more good for the company can be done than by any other means of printed advertising, always provided the articles are true.

The daily newspaper advertisement can be made next effective if the reading public are at all sympathetic or interested in the company, but as a means of converting an antagonistic public, it is of doubtful effect, unless the papers themselves are fair or, at least, unbiased toward the company.

A small antagonistic news item in the same edition as the company's advertisement will, to a large extent, neutralize the effectiveness of the carefully prepared ad.

The next method of importance in our opinion is that of bill board, street car and electric sign advertising. Possibly the electric sign should be placed first of these three, as an electric company should endeavor to practise what it preaches. On the other hand, the electric signs, especially the flashing enormities that are seen in New York and other large

*Presented before the C. E. A. Convention.

cities, are better adapted to advertise manufacturer's articles than a central station service. We believe that dignity is lacking in many of the modern signs, and the flashing qualities are a detriment and more or less objectionable from our standpoint where service and steadiness without flamboyant and spread eagle boastfulness are to be accentuated.

Bill boards properly illuminated should be a good medium of advertisment, provided they are made attractive and pleasing to the eye and made up so that he who rides may read.

Street car advertising is more or less effective, but is more adapted for appliance advertising than for any other branch of our business.

The fourth division, weekly papers and magazines, are much in the same category with the daily newspapers, except that they are liable to be read on Sundays in the homes and less hurriedly than the dailies, but, if the editorial departments are antagonistic, their efficiency is largely weakened.

The other methods of printed advertising, namely, theatre programmes, baseball score cards, charity entertainment programme ads., etc., give probably less results than those previously mentioned, but, if the material is carefully compiled can be made of some benefit to the company.

On the whole the best method in our opinion of advertising the company's business is service, by which we mean delivering the goods in every branch of the organization with efficiency and courtesy.

Public Utility Service

The Value of "Service"—Prompt, Courteous and Continuous—Outlined

By Mr. Stephen L. Coles*

Service is a fundamental necessity in the upbuilding of any public utility.

In none of the several lines of public utility endeavor is service of more importance than in the ramified business carried on by the central electric station.

For no other one business comes so near to the people as does that of the central station. It supplies light, heat and power to the home, the store, the office, the hospital, the theatre, the factory and frequently for transportation.

The successful sales manager of a central station has a better grasp of the social, political and business conditions in his community than any one else. By virtue of his position he gets a bird's eye view of his city as a whole, and of necessity accumulates a wealth of intimate detail through his personal, direct contact with all sorts of people.

If a magazine editor, or the managing editor of a daily newspaper, had the same opportunity of gauging his public, he would forthwith produce a magazine or a newspaper that would almost eliminate competition.

The success of a central station, not only as a public utility, but as a business proposition carried on for the profit of its stockholders, is in direct ratio with the service it gives.

I do not hesitate to say that the rate of dividend is to a very great extent dependent upon the degree of service.

Naturally, perfect service is 100 per cent. efficient and we place it as the idol of our hopes on the same pedestal as the operating engineer places his ideal load curve—the straight line.

It is only within the past ten years, say, that the real importance of service has received the full attention of central station executives. The growth of appreciation of its value has been so rapid, however, that to-day we hear the officials of public utility companies strenuously urging the abandonment of the term "central station" for the newer and more appealing title "service company."

Rapid as has been the change of heart on the part of central station managers, even more sudden and surprising has been the education of the public as to just what "service" should mean to them. At the present moment, the public is quite sufficiently informed to demand and insist upon service. There is but one alternative for the central station. It must give service. Failure to do so will at once impair the good will of the company, indirectly lessen the value of the existing plant, growth and progress will halt in their tracks, and an unseen, but none the less powerful opposition to the company will be engendered. Carried to the limits, such a state of affairs points but one way—to the chasm under the warning signboard "competition."

Any and every central station should adopt a "service" policy for purely selfish business reasons. Even a brief analysis of the question will demonstrate that the interests of the company and those of the public are identical. Therefore the central station that serves its public well, serves its stockholders and itself equally well. In these days progress in any business is founded on service.

The most valuable asset a central station can possess is the good will of the public it serves. And this good will many be increased and made to grow to a wonderful extent by constant improvement in every detail of service.

Nothing that enters into service or has a bearing upon it is trivial. The central station manager who has his mind and his eye on the little details of his business is the one who is constantly approaching the ideal of service. Nothing is unimportant that affects in the slightest degree his relations with the public.

Having established the vital importance of this matter of service, let us attempt to answer the natural inquiry: "What is service?"

One dictionary definition is: "An agency for the accomsome general and recurrent demand." The lexicographer who coined this definition easily might have taken the central electric station as a concrete example for the purpose.

Another definition is: "The act or means of supplying some general demand."

It follows, therefore, that **every point of contact between the company and a customer is an opportunity for service.** The manner in which any such opportunity is grasped is an exact demonstration of the company's ability to give service.

*Presented before the C. E. A. Convention.

New Books

Electric Wiring & Lighting—By Chas. E. Knox, E.E., and Geo. E. Shadd, E.E.; the American School of Correspondence, Chicago, publishers. Price $1. The material in this volume is specially adapted for purposes of self construction and home study. The utmost care has been taken to make the treatment of each subject appeal not only to the technically trained expert but also to the beginner and the self-taught practical man who wishes to keep abreast of modern progress. The language is simple and clear, heavy technical terms and difficult formulae having been avoided, though without sacrificing any of the requirements of practical instruction. The book is divided into two parts. Part I. dealing with electric wiring and Part II. with electric lighting. For purposes of ready reference and timely information it is believed this handbook will be found to meet the general requirements. It is very well illustrated and printed and bound to sell at a higher price.

The Electric Reduction Company, Limited, of Buckingham, Quebec, are putting in an hydraulic development to generate 3200 horse-power. Possibly half of this amount will be used to generate alternating current electric energy. Mr. W. A. Williams is managing director of the company.

Constant Voltage Transmission Lines

A Discussion of Better Regulation of High Voltage Transmission Lines by Control at the Receiving End as Well as at the Generating End

By Mr. H. B. Dwight*

For deciding upon the method of operation of a transmission system, two distinct alternatives are presented, one of which has been brought forward but recently. In the older method, which is the one in common use, the voltage of the system is controlled entirely from the generators. The disadvantage is the large variation in voltage, which is indeed the factor limiting the carrying capacity of the system. In the newer method, there is no voltage variation at all, this result being obtained by controlling the voltage from both the generating end and the receiving end. The newer method also increases several fold the carrying capacity of a transmission line. This new constant-voltage method has been used successfully in commercial operation though as yet only on small systems. It offers large advantages both in better service and in lower cost over the usual varying-voltage method.

It is proposed to make a comparison in the following paragraphs between the two methods, dealing especially with the reduction in cost made possible for large power systems, the reliability of the new method, and the ways in which the new method of operation may influence the design of transmission systems.

The method in common use with transmission lines needs but little description as it consists merely of controlling the voltage on the line by adjusting the voltage of the generators supplying the power. Since at no-load the two ends of the line are at approximately the same voltage, while under load there is considerable drop at the receiver end, a variation in voltage is unavoidable as the load increases or decreases. This variation may take place at the generator end or the receiver end, as desired, but in either case it put a limit on the amount of power which the line can transmit. A system which delivers electric power to a customer at a voltage varying 10 or 15 per cent. throughout the day is not considered to be giving good service, as the operation of lights and motors is seriously interfered with. Therefore when the load on a transmission system becomes so large as to produce too great a variation in voltage for good service, it has been the customary practice to build additional transmission lines, or to adopt a higher line voltage. It is at this stage that constant-voltage transmission appears most attractive, as it provides greatly increased carrying capacity without any alterations in the transmission line itself.

The constant-voltage method of control is radically different from the usual method. Instead of controlling the voltage from one end only, special machinery consisting generally of synchronous motors or synchronous condensers is installed at the receiver end, and the voltage is controlled at that end also by adjusting the power factor. Enough synchronous motors are installed to keep the voltage at a steady value at both the receiver end and at the generator end.

The way in which the synchronous motors operate to hold the voltage constant is very similar to the way in which they are frequently used to improve the power factor of a load. It is well known that a large part of the voltage drop in a transmission line is due to the line reactance. The reactance drop is greatest when the load has a low power factor, and it is, in fact, directly proportional to the lagging reactive component of the load. The drop is therefore changed into a rise in voltage if the reactive component is leading instead of lagging, and this may be sufficient to overcome the drop due to resistance. This is expressed in symbols as follows:

Let R be the resistance of the line and X the reactance. Let P be the in-phase component of current and Q, the lagging reactive component. Then the drop in voltage is approximately

$$PR + QX$$

or, more exactly,

$$PR + QX + \frac{(PX - QR)^2}{2(E + PR + QX)}$$

where E is the voltage at the receiver.

If now Q is made negative, that is, if it is a leading current, QX opposes the drop PR and tends to neutralize it. The quantity Q can be controlled by adjusting the field current of the synchronous motors, since with a strong field the motors will operate with a leading current. It is therefore possible to control the voltage at the receiver end by adjusting the field current of the synchronous motors. This adjustment must be under the control of the transmission line operators in order to have the correct effect on the line voltage.

In water-power plants the voltage and also the frequency are subject to sudden changes due to variations in load which are too rapid for the water wheel governors to compensate for immediately. In such cases a large flywheel effect on the system tends to minimize this trouble. Synchronous motors add directly to the flywheel effect and are found very useful in this way.

The advantages obtained from the use of synchronous motors by maintaining constant voltage at both the generator and receiver ends of the line and by adding to the flywheel effect, have been sufficient to warrant their installation on several short transmission systems. In such cases the improvement in the service given to customers at all parts of the system justified the additional expense. But when it is stated that the synchronous motors must be equal to one-half or two-thirds of the generator capacity the cost will at first sight seem prohibitive for most cases. In consideration of this, the additional fact must be taken into account that the newer method not only improves the service, but very greatly increases the carrying capacity of the line. Since with a line of about 100 miles in length the cost of the generators is comparatively small compared with the cost of the line, the installation of synchronous motors will actually

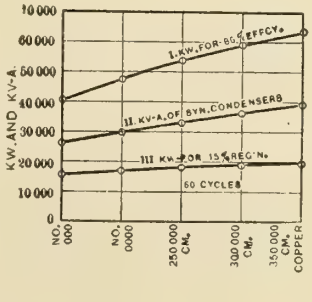


Fig. 1

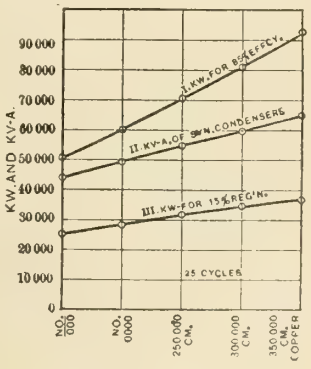


Fig. 2

* Presented before the A. I. E. E.

save money in large systems, by saving extra line construction.

The limit of carrying capacity is ordinarily set by the maximum variation in voltage allowed for good service, that is, by the regulation of the line. But if there is no voltage variation at all, another limit must be looked for, and this will be found in the greatest energy loss which can be allowed for the transmission. Power for supplying line losses costs very little in most systems, so that an efficiency of 85 per cent. is generally consistent with good economy. The curves for Figs. 1 and 2 for constant-voltage lines have been plotted for this value of efficiency. A glance at these curves shows that the carrying capacity of a 25-cycle line can be doubled by adopting the constant-voltage method, and the capacity of a 60-cycle line can be multiplied by two or three.

It is shown in the diagram, Fig. 5, that there is a maximum amount of power for a constant-voltage line, which cannot be exceeded under any conditions without raising the voltage, no matter how low the efficiency is allowed to become, nor how much synchronous machinery is installed. This has been pointed out by Mr. Philip,* and a diagram given for the case where the receiver voltage is equal to the generator voltage. The practical limit to the carrying capacity of a line is smaller than the above maximum, due in most cases to the energy loss becoming excessive and to the rapid increase in the amount of synchronous condensers required. The present paper therefore uses as a practical limit a moderate percentage of loss, such as corresponds to about 85 per cent. efficiency.

The saving in cost effected by the constant-voltage system increases very rapidly as the number of miles of line becomes greater. The curves of Fig. 3 show that for 60 cycles, the cost of a constant-voltage line with the necessary synchronous motors represents a saving when the length is over 70 miles. For 25 cycles, Fig. 4, the saving over the varying-voltage method is not obtained until the length is 120 miles or more. As noted elsewhere, no allowance has been made for cost of land, owing to the extreme variableness of this item. If this were included, the constant-voltage curves would show more favorably. On the other hand, no allowance has been made for the cost of power for line losses, which are greater for the constant-voltage lines used in calculating the curves than for the corresponding varying-voltage lines.

The costs as plotted are merely approximate, and are not intended to give an actual estimate of what a transmission line would cost. The curves are presented rather to show the effect, on the cost, of changing certain factors such as size of conductors, length of line, and method of control.

The comparisons in Figs. 3 and 4 are not quite complete, owing to another saving in cost which is possible when designing a line for constant-voltage work. This saving is made by using large conductors. The cost curves show that with an existing line of considerable length it pays to install synchronous motors if enough power is to be transmitted to utilize the line to its full capacity of the new basis. As may be noted from the first two figures, the increase in carrying capacity, and therefore the saving in cost per kilowatt, is greatest when large conductors are used. In ordinary transmission there is practically no advantage in using a larger conductor than about No. 4/0 copper for 60 cycles. Reducing the resistance to a value less than one-third of the reactance does not materially improve the regulation, which is determined under these conditions almost entirely by the reactance. But with constant-voltage operation, a large proportion of reactance to resistance within a certain limit is no longer a hindrance, and so large conductors can be used to good advantage. This increases the carrying capacity of the line at small extra cost.

*R. A. Philip, *Economic Limitations to Aggregation of Power Systems.* TRANS. A. I. E. E., 1911, p. 612.

It may be mentioned as a minor consideration that a line with large conductors will have a comparatively small amount of corona loss, and so it may be operated at a higher voltage than where smaller conductors are used.

It was pointed out that high reactance is a detriment to a line operating with varying voltage but is not such a great disadvantage when the constant-voltage method is used. For instance, Figs. 1 and 2 show that a smaller proportion of synchronous motors is needed with a 60-cycle line than with a 25-cycle line. This is due to the higher reactance of the 60-cycle line. Now the reactance used in estimating the curves has been merely the reactance of the line. The reactance of the entire circuit includes that of the generators, step-up transformers, protective reactance coils, and step-down transformers, as well as the line reactance. Of late years it has been customary in large systems to make all these reactances as large as possible for protective reasons, in spite of the fact that they tend to make the regulation poor, and so limit the power which can be transmitted. High reactances give pro-

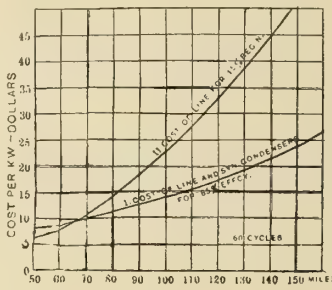


Fig. 3

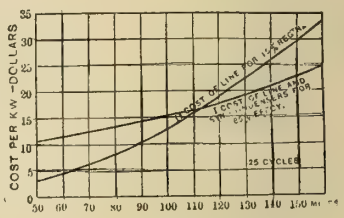


Fig. 4

tection by reducing short-circuit currents, which are tremendous in large power stations and are very destructive both in their heating effects and in the mechanical distortions which they produce in the apparatus. High reactance in the reactance coils placed between the line and the station apparatus gives very effective protection against abnormal voltages due to lightning, and to surges caused by switching. It is evident that with constant-voltage transmission it will be economical to increase all these reactances much beyond the values in use at present and better protection will thus be obtained. It may therefore be stated that the possibility of using high reactance in all the various kinds of apparatus connected with the system, is one of the most important points in favor of constant-voltage transmission.

It may safely be stated that the reason why the frequency of 25 cycles was adopted to any extent in this country was because its low reactance made it more economical for transmission. This is shown by the curves of Figs. 3 and 4. The same figures show that with constant voltage, the frequency of 60 cycles becomes as economical at 25 cycles. With the exception of railway work, the frequency of 60 cycles is preferable for most important applications of electric power, especially the supply of power to large cities. The cost of generators, transformers, and motors is generally less at 60 cycles, and the operation of most lighting devices, especially tungsten lamps and arcs, is much more satisfactory at the higher frequency. Any method, therefore, which tends to make 60-cycle transmission more economical than 25-cycle, should be welcomed, as it will assist in standardizing the electric machinery of the country at the single frequency of 60 cycles.

The most advantageous application of constant-voltage transmission is probably not in transmission lines with a single generating station, but rather in large transmission networks connecting all the hydro-electric plants and the cities within a radius of several hundred miles. The generators placed at various points of the network themselves partly take

the place of the synchronous motors for maintaining constant voltage, and thus the total capacity of synchronous motors required is somewhat less. Duplicate lines for use as reserves in case of breakdown are not required as much in networks as in straight transmission projects, since power can generally be supplied to any point from more than one direction. Thus a small number of heavy lines can be used in networks, and constant-voltage operation is especially applicable to these. All the advantages of low cost, good service, and good protection which have been described for constant-voltage transmission lines, are to be obtained with a large transmission network operated with steady voltage at both generating and receiving stations.

Very large transmission networks have already grown up, and are steadily increasing in extent. The engineering advantages of combining small power systems into one large network are due to the combination of differing load curves, water storages, reserves in case of breakdown, and even differences in standard time, etc. These have been discussed so thoroughly that they need only be mentioned here. The principles of constant-voltage transmission can greatly increase the economy and range of operation of large transmission networks. It does not seem unreasonable in view of the already rapid growth of many of these systems, to state the possibility of a single high tension network for the supply of power over the entire country.

When larger transmission networks are advocated it might be objected that the limit has been already reached of

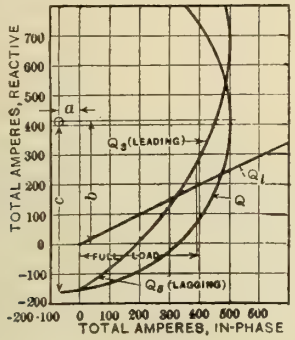


Fig. 5

the number of generating stations which can be connected to one network, owing to the danger from such large amounts of generator capacity when a short circuit occurs. But a network which is operated at constant voltage contains an unusually large proportion of reactance, both in the line and in the station apparatus. Thus when a short circuit occurs the voltage drop toward the short circuit is very rapid. Power is delivered to it practically only from the near-by generating stations of the network.

For example, if a short circuit occurs 100 miles from a station and the voltage is sustained at 100,000 volts, 60 cycles, at the generating station, a current corresponding to only about 100,000 kv.a. will be delivered from the station. This is not such an excessive amount as to interfere with the safe opening of the circuit breakers. The presence of protective reactances very greatly reduces the short-circuit current, so that it may be said that a station 100 miles away from a short circuit cannot send a dangerous amount of current to the short circuit.

The greatest danger, then, comes from a short circuit in the immediate neighborhood of the largest generating station, and in that case the short circuit current is supplied almost entirely by the nearest station. The largest circuit breakers will therefore not need to be designed with regard to the capacity of the entire network, but only of the stations in which they are located. Circuit breakers are at present in successful operation in connection with as large generating plants as are likely to be constructed and so the problem of handling short circuits will probably not impose a limitation upon the size of transmission networks.

The two systems of varying-voltage control and constant-voltage have been described as being quite distinct. There is really, however, a middle ground between them. For instance, consider a line operated with 20 per cent. voltage variation at the generators between no-load and full load, and with a steady voltage at the receiver. Now by installing a small number of synchronous motors at the receiver, the generators may be operated with only 10 per cent. variation, the synchronous motors being used to hold the receiver voltage constant. Twice the number of synchronous motors would allow constant-voltage operation at both generators and receivers. It is possible, therefore, to install a small amount of machinery and obtain a proportionate improvement in closer regulation or in increased carrying capacity of the line.

The above fact is of great importance in relation to the commercial application of the principles of constant voltage operation, since a new method appears much more attractive to a transmission company if the change can be made gradually without interrupting service, and if the results of a small alteration can be observed before investing any large amount of capital.

Many power companies offer special terms to induce their customers to install synchronous motors and thus raise the power factor of the load. This can scarcely be called a step in the direction of using the principles of constant-voltage transmission, since the field current of the synchronous motors is not adjusted with a view toward regulating the line voltage. The advantages of a high power factor of load are very small indeed compared with the large advantages to be obtained from adjustable power factor.

It must not be supposed that the voltage at all points of a constant-voltage transmission line or network has exactly the same value. At all points where there are generators or synchronous motors whose field current can be adjusted, the voltage will be held steady. For the best economy, however, the generator voltage should be held at a higher value than the receiver voltage. Thus the voltage at the generating stations may be held constant at 110,000 volts, while the voltage at the receiver stations may be held steady at 90,000 volts. This involves running the synchronous motors with a weak field and a lagging power factor at no-load, and there is a limit in doing this when the motors are carrying a mechanical load, due to the danger of the motors dropping out of step. However, the capacity of synchronous motors required is so large that most of them would have to run unloaded as synchronous condensers, since mechanical loads could be found for only a few of them. The curves which have been given assume that the synchronous condensers will operate at their full rating of lagging current at no-load, as well as with leading current at full load.

Synchronous condensers can be designed so as to remain in step, when running unloaded at 100 per cent. power factor, as tenaciously as a fully-loaded induction motor. If necessary, the starting torque could be sacrificed for the sake of the synchronizing power, and the condensers could be started by small starting-motors, though it would be preferable to have them self-starting. At times of very light load on the line, such condensers can operate safely with weak fields and lagging power factor. Thus, in spite of the fact that loaded synchronous motors and synchronous converters are commonly regarded, and rightly so, as a very unstable element in transmission line operation, it may be stated that the addition of properly designed unloaded synchronous condensers to a transmission system, as described in this paper, does not decrease the reliability of the system. In fact, the extra reactance which would be used, as described above, renders the line more reliable instead of less so. It may be mentioned that probably more time would be taken in getting load on a line, after a temporary shut-down, where synchronous con-

densers are installed, but this is not a serious disadvantage if the system is more safe and dependable.

The charging current of the line due to the condenser effect is the same under all conditions of load, and does not affect the amount of machinery necessary for the adjustment of the line voltage as described in this paper. The effect of the charging current is to raise the voltage at the receiver, by a constant amount. The operation of a long constant-voltage line is made more satisfactory by the charging current, but the charging current cannot be considered a help when the line is operated with varying voltage.

It has been found in commercial practice with short lines that constant voltage transmission is worth while merely on account of the improvement in service. In the following paragraphs, estimated costs are given for comparatively long lines, so as to show, even more definitely than by the curves already discussed, that where a line is long, or land is high in value, it pays to adopt constant-voltage transmission, even without considering the improvement in service.

Summary

Constant voltage transmission requires adjustable power factor.

Advantages

1. Better service—no variation in voltage.

COMPARISON OF THE TWO SYSTEMS FOR A 200-MILE TRANSMISSION PROJECT

	The usual varying-voltage method	Constant-voltage method
Distance	200 miles	200 miles
Power delivered	33,000 kw.	33,000 kw.
Power factor of load	90 per cent	90 per cent
Frequency	60 cycles	60 cycles
Number of three-phase circuits	3	1
Conductors, copper cable	No. 0000	350,000 cir. mil.
Maximum voltage on line	116,000	116,000
Voltage at load end	100,000	85,000
Reactive drop in transformers at each end	4 per cent	5 per cent
Reactive drop in protective coils at each end	4 per cent	7 per cent
Synchronous condensers at load end	None	18,000 kv-a.
Synchronous condensers required at no-load		16,500 kv-a.
Voltage variation	21 per cent	None
Voltage variation due to line alone	14 per cent	None
Efficiency of transmission	94 per cent	87 per cent
Power factor at generators	99 per cent lagging	89 per cent lagging
Approximate Costs.		
Towers, ground cables, insulators and erection	$1,140,000	$440,000
Copper cables, at 18 cents lb	1,080,000	600,000
Synchronous motors and space in substations, at $10.00 per kv-a		180,000
Cost of line, exclusive of land	$2,220,000	$1,220,000
Saving		1,000,000

N.B. The charging current of the line was allowed for in calculating the above results.

COMPARISON FOR A 100-MILE TRANSMISSION SYSTEM

	Varying-voltage method	Constant-voltage method
Distance	100 miles	100 miles
Power delivered	54,000 kw.	54,000 kw.
Power factor of load	80 per cent	80 per cent
Frequency	60 cycles	60 cycles
Number of three-phase circuits	3	1
Conductors, copper cable	250,000 cir. mil.	400,000 cir. mil.
Maximum voltage on line	113,000	113,000
Voltage at load end	100,000	90,000
Reactive drop in transformers at each end		5 per cent
Reactive drop in protective coils at each end		5 per cent.
Synchronous condensers at load end	None	42,700 kv-a.
Synchronous condensers required at no load		21,500 kv-a.
Regulation due to line alone	15 per cent	None
Efficiency of transmission	95 per cent	91 per cent
Power factor at generators	87 per cent lagging	89 per cent lagging
Approximate costs.		
Towers, ground cables, insulators and erection	$618,000	$227,000
Copper cables at 18 cents per lb	,642,000	343,000
Synchronous condensers and space in sub-stations at $10.00 per kv-a		427,000
Cost, exclusive of land	$1,260,000	$997,000
Saving		263,000

N.B.: The charging current of the line was allowed for in calculating the above results.

2. Better protection, due to high reactances.

3. Tendency to use the frequency of 60 cycles.

4. Increased carrying capacity of line. The limit is changed from maximum voltage variation to maximum energy loss. This allows more power to be transmitted or the distance to be increased, without the voltage being raised.

5. Lower total cost for long lines. The saving cost is greatest for long lines or large networks, large quantities of power, large conductors, and for the frequency of 60 cycles.

6. The method is easy to apply to existing lines. The change can be gradual, and no change is necessary in line construction.

Disadvantages

1. Cost and attendance of additional rotating machinery.

2. Higher total cost for short lines.

3. In order to obtain the greatest economy from constant-voltage operation, the losses must be increased, and the number of separate lines, which are useful as reserves, must be reduced.

4. Tendency of synchronous machinery to drop out of step, and delay in putting load on the line again after shutdown.

The author also appends some further data concerning formulae for the voltage drop from generator to receiver.

The Canadian National Exhibition

The committee which have the Canadian National Exhibition for 1913 in charge have just issued Bulletin No. 1, in which they outline in part the special features of this autumn's exhibition, which, in many of its details is calculated to excel anything that has been shown in previous years.

Arts exhibit—This year the galleries will be divided into four sections, British, German, United States and Canadian, and the entire exhibit promises to be a distinct advance over all previous collections that have featured the Canadian National.

Water carnival—Aquatic sports will be a feature at this year's exhibition and will include motor boat races, war canoe races, swimming races, aeroplaning, hydroplaning, etc.

New midway.—A brand new midway, with brand new shows is advertised for the present year. It is said that the objectionable features have been eliminated, and that this part of the exhibition will be carried out according to a much higher standard of amusement.

Music—This will be furnished by the band of the Irish Guards which created such a favorable impression in 1905, and by Patrick Conway's band which is along the line of the famous Gilmore band. These will each give two concerts daily.

Live stock—The new live stock department will this year give splendid accommodation for the fine animals for which the big fair is noted, and will, at the same time, add a finish to the artistic appearance of the grounds.

Scenic production—This year's evening pyrotechnic display will be supplemented by one of the most elaborate scenic productions ever shown on the continent, in the reproduction of that splendid historical spectacle, "The Burning of Rome." The evening performance will require some 800 performers.

The record attendance at the Canadian National Exhibition at present stands at 962,000, a matter of 38,000 below the million mark. This year it is hoped to reach at least the million mark, and it is quite likely this number will be exceeded.

The ratepayers of Gananoque passed, by a big majority, the by-law to give the Electric Light Company a ten-year contract and a thirty-year franchise. They also carried the by-law re Gananoque and Arnprior Railway.

ELECTRIC RAILWAYS

The Pittsburgh Autobus Line

The Pittsburgh Auto Transit Company was organized for the purpose of supplementing existing street railway lines and providing a frequent, fast and comfortable means of automobile transportation through a high-class residential district. Eight large single-deck omnibuses with Brill-built bodies, mounted on White chassis, were placed in the new service, which will probably extend into other parts of Pittsburgh. The machines run from the City Hall, past the Union Station, along the Grand Boulevard section to Highland Park. The route is about six miles long. Near Highland Park, the east end of the route, the east and west-bound lines separate, passing through a well-developed business section.

The new omnibuses are noteworthy in several respects: they have an unusually large seating capacity for a single-deck vehicle—34 persons—which is equal to that of the standard double-deck machines used in London, England; they have longer and wider bodies than usual and are operated on the one-man prepayment principle. The latter point is especially interesting because it demonstrates the extent to which one man can control both car and passengers in a heavy-traffic zone, with a seating capacity greater than that



Type of Autobus Operating in Pittsburgh—Seating Capacity 34.

of a single-truck electric car, and operating methods requiring not only greater attention but more skill and a higher degree of mentality.

A single doorway is used for both entrance and exit. The chauffer's seat is directly opposite, giving him a clear view ahead and to both sides. The lever by which he controls the double-leaf folding door is in convenient reach of his left hand. A wood partition, with a pipe stanchion extending to the roof, is placed next to the doorway to prevent interference between passengers in the longitudinal seat on that side and those boarding or alighting. A stationary cross seat is backed against that occupied by the chauffer; the remaining seats are also of the stationary transverse type. An emergency exit is placed in the rear end, and when closed is covered by a portable seat. The windows have an interesting feature in the stationary upper sashes set in a single frame that extends from end to end; the reinforcement so given the body structure is obvious. The lower sashes are made to raise their full height.

Following are the principal dimensions:

Length of body	23 ft. 0½ in.
Centers of side posts	2 ft. 4½ in.
Width over sills	7 ft. 7 in.
Width over posts (rear)	8 ft. 0 in.
Width over posts (front)	7 ft. 0 in.
Extreme width	8 ft. 2¼ in.
From pavement to side sills	2 ft. 9 in.
From side sills over roof	7 ft. 5 in.
From floor to center of headlining	6 ft. 10½ in.
Street to first step	14 in.
First to second step	11 in.
Second step to floor	11 in.
Seating capacity	34
Type of chassis	White 5-ton
Wheel base	19 ft. 1 in.
Diameter of wheels; front 36 in.; rear	40 in
Weight of chassis	8,500 lb.
Weight of body	5,100 lb.
Total weight	13,600 lb.

New Cars for Regina

The corporation of the city of Regina recently received a shipment of eight double truck cars for their municipal street railway system from the Preston Car & Coach Company. This makes a total rolling stock of twenty-eight cars made up of eighteen double trucks and ten single trucks.

The specifications of the new double truck cars are as follows:—The length of the car body 28 ft.; front vestibule, outside, 5 ft.; rear vestibule, outside, 7 ft.; projection of bunters 6 ft.; length of car over bunters 41 ft.; width of car over side sheath 7 ft. 8 in.; height of car from bottom of sills 8 ft. 9 in.; width of front vestibule door 30 in.; width of rear vestibule door 48 in.

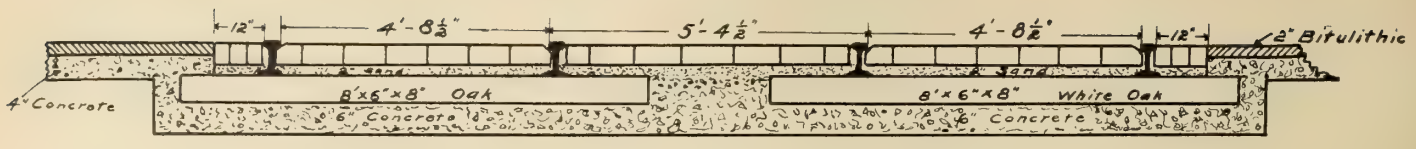
The motors are Canadian Westinghouse type No. 101B, and Canadian General Electric Quadruple 80. The air brakes are Peacock hand type and Canadian Westinghouse straight air. Cars are p.a.y.e. semi-convertible; trucks are Brill 27 GI. double; wheels are Midvale all-steel 33 in. diameter; axles are Midvale hot rolled steel; Providence fenders; Root scrapers; Crouse-Hinds imperial junior arc headlights.

Mr. H. Doughty is superintendent of the Regina municipal railway system.

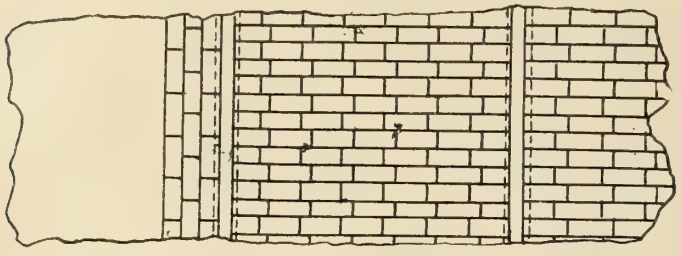
Toronto's Traffic Rules

Acting under the Public Health Act at the last session of the local legislature, Dr. Hastings, Toronto's Medical Health Officer, has framed a number of rules to regulate street car and other traffic in the city of Toronto. The rules are as follows:—

From and after the approval of these regulations, all companies or corporations operating street passenger cars or vehicles constructed and used for the purpose of carrying passengers, whether propelled by horse, electricity, or cable power, are prohibited from hauling, carrying, or conveying in any car at one time a greater number of passengers than is equal to 1 2-5 times the proper seating capacity thereof, with the addition of five passengers on the rear platforms of each car, and said railway companies or corporations are



Track Construction of Berlin & Waterloo St. Ry.



Half Plan of Track Allowance

Fig. 1—Berlin and Waterloo track construction

further prohibited from carrying any passengers between the seats of open summer cars.

None of the said street cars or vehicles shall be furnished with cushions on the seats or back made of any material that cannot be readily cleansed and disinfected, and all cars shall be so constructed as to provide for and secure efficient ventilation and heating at all times, to the satisfaction of the Medical Officer of Health.

A Fahrenheit thermometer shall be hung in the centre of each and every car.

Each and every street car used for the transportation of passengers shall, on the days on which it is used for such purpose, be carefully and thoroughly washed and cleansed on the inside, and all cushions and upholstering throughout cleansed by means of a vacuum cleaner.

All straps or hangers on any of the aforesaid cars shall be composed of or covered with celluloid, or a similar non-absorbable material, and must be regularly cleaned, as ordered by the Medical Officer of Health.

B. & W. Track Construction

The Berlin & Waterloo Street Railway System, operating in and between these two towns, have in the past used a 6 in. T rail, Loraine Steel Company, Section 72, No. 331. These rails are received in 62-foot lengths and jointed by special fish plates as shown in cross-section in Fig. 2 herewith. The plan of track construction is illustrated in Fig. 1. White oak ties rest on a 6 in. concrete bed. The gauge is 4 ft. 8½ in. with 5 ft. 4½ in. devil-strip and 12 in. paving on each side of outer rails. Paving blocks rest on a 2 in. sand cushion. Surface plan of track allowance is also shown in Fig. 1. Mr. V. S. McIntyre is superintendent of the street railway department which is under the control of the Berlin Light Commissioners.

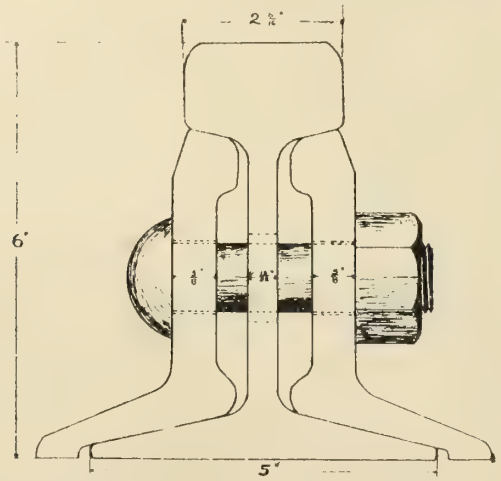


Fig. 2—B. & W. track construction

M. & S. C. Developments

The Montreal and Southern Counties Railway have now a regular service from Montreal to Chambly and Richelieu, this being the latest extension of the company's system. The cars are of a new type, at least so far as this company is concerned, constructed by the Ottawa Car Company. Each car has a seating capacity for 56 persons, three to four cars making up the usual train. Four 50 h.p. motors are installed on each car and the whole train is controlled by the motorman in the leading car by means of the multiple control system. The cars are equipped with automatic air brakes with emergency attachments, and also with automatic and foot sanders for forcing sand upon the rails. Three electric locomotives were recently ordered by the company from the Ottawa Car Company, each capable of hauling eighteen loaded freight cars. The entire electrical equipment for the cars, locomotives, station, sub-station, etc., has been supplied by the Canadian Westinghouse Company. The Chambly sub-station contains three 185 kw. 25,000/2,300 volt single-phase transformers which operate a 600 h.p. 3-phase slip-ring type motor-generator set.



3 car train, Montreal to Chambly

Will Electrify Steam Line

The Pacific Great Eastern Railway Company which at present is constructing a line from Fort George to North Vancouver, is prepared to electrify that portion of its route extending from Horseshoe Bay on Howe Sound through West Vancouver to North Vancouver, a distance of about 10 miles, providing these municipalities will grant the company a 60-foot right-of-way through this territory free.

It is proposed to operate an hourly service from 6 a.m. until midnight with additional trains on holidays. The company intends to proceed with the construction of this portion of its line immediately the request for a free right-of-way is complied with.

A number of property holders along the route are willing to accept the proposition, and at the present time it would seem that there are good prospects of the matter reaching a satisfactory settlement.

Illumination

Illumination of Toronto Hydro-electric Store

A great deal of attention has been attracted by the recent installation of lighting in the Toronto Hydro-electric office on Yonge street. There is probably no office in Canada that entertains as many visitors or has as many people passing it as this office and every effort is made by Mr. Charles Dudley, who has charge of the sales and display room, to bring the attention of the public to electric devices of merit for all purposes. To make this room the best lighted room in Canada was one of his ambitions, and to accomplish this there was recently installed twenty-six Holophane Realites—twenty in the office proper and three in each of the two windows. The effect of this installation is wonderful. The office is not only as light as mid-day on a bright June day, but it has a quality of light that equals it. It is a magnificent demonstration of what can be accomplished by



Interior Toronto Hydro Electric Store

scientific study of the lighting needs. The Holophane Realite is a Toronto product and one to be proud of. It is meeting with an unusual demand for high class store and large room lighting.

Beautiful Glassware Display

During the Canadian Electrical Association Convention many of the visitors, as well as the many passers-by, were attracted by the beautiful display of lighting glassware in the Toronto Hydro-electric System window on Yonge street. This display was loaned to the Hydro for the occasion by The Holophane Company, Limited, Toronto, and consisted not only of their Holophane reflectors, Holophane Realites, Holophant D'Olier steel and enamel reflectors, but also bowls of many shapes and pleasing designs for semi-indirect lighting. These were shown in the Calla and Veluria glasses which are distinctively different from the ordinary white glasses that have become so common. Attention was called to the various types of glass by neat signs, one of which advised the many lookers that there is a Holophane globe or



Glassware Display in T. H. E. Windows

reflector for every need. Quite a number of the large units shown were under light, and a flasher arrangement under two of them gave a constant and beautiful change of colored lights. Another sign called attention to the fact that Holophane glass is now a Toronto product and that the Holophane Realite was endorsed by the Hydro system. As a whole the display was a great credit and received most favorable comment.

Illuminating Engineering Society

It has been definitely decided to make the Hotel Schenley the headquarters of the Illuminating Engineering Society Convention which will be held in Pittsburgh, September 22-26. The programme as outlined at the present time covers an exceedingly interesting set of papers on the various subjects pertaining to illumination. In addition to the technical sessions of the Society, the Local Committee has arranged for a series of entertainment features in which the ladies are included. These features cover golf, tennis, base ball games, automobile rides, theatre and card parties, and conclude with a banquet at Hotel Schenley at which some innovations are promised. Inspection trips have been arranged to several industrial plants including the Westinghouse Electric & Manufacturing Company, Macbeth Evans Glass Company and the Carnegie Steel Company; also a luncheon at the H. J. Heinze Company, the home of the 57 varieties, for the ladies.

The papers as scheduled at this time include, among a number of other subjects, the Quartz Light, Fontune, and Neon Tube; Church, Factory, Store, Hospital and Street Car Lighting, The Present Commercial Development in sev-

eral forms of Lighting, Errors in Photometric Measurement, and the History of Artificial Lighting. In addition to these, a number of others on equally interesting subjects will be presented by authors well-known to the engineering profession in illuminating as well as other fields. The development of the new flame carbon arc lamp will also be discussed by representatives of the manufacturing concerns. An interesting feature in connection with the technical sessions will be the holding of symposiums on the various general subjects to be led by those particularly well posted on the different subjects. These meetings will afford an opportunity for free and open discussion that it probably would not be possible to obtain in a more formal meeting.

The A-B Tungsten Arc

The two illustrations herewith represent the most recent product of the Adams Bagnall Electric Company. It is a unit specially adapted to large store lighting and has also



recently been adopted by the C. P. Railway Company for round-house illumination. To all appearances it is also well suited for street lighting purposes where first cost is a prime consideration. These units are equipped with G-65 ABolite



reflector and the focusing type globe. It will be seen from the figures that the lamp units are easy of access for replacing or cleaning. Lamp sizes of 500 or 1000 watts are generally used.

The Walkerton Electric Light and Power Co.

New Hydro-Electric Plant on the Saugeen River, Two Miles Above the Town

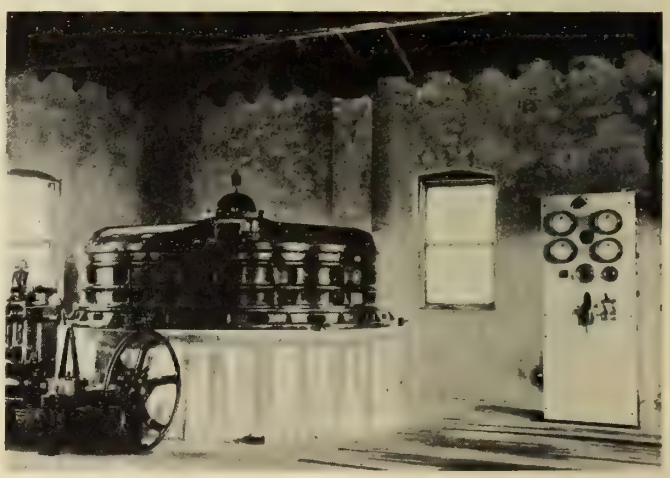
The Walkerton Electric Light & Power Company of Walkerton, Ont., have just placed their new hydro-electric power station in operation. The new plant is situated about



New power house—Walkerton

2 miles above the town of Walkerton on the Saugeen River, where a substantial concrete dam has been built, giving a normal head of 9 ft. The power house has been built about 800 yards below the dam by which arrangement an additional head of approximately 3 ft. is obtained, so that a normal working head of 12 ft. has been secured.

The plant at present consists of a 150 kw. 2300 volt, 3-phase, 60-cycle generator operating at 120 r.p.m. The gen-



Generator, switchboard, etc.—Walkerton

erator is a Swedish General Electric vertical type machine, with ball thrust bearing carrying the weight of the rotor and water wheel runner. The water wheel, which is direct connected, is William Kennedy manufacture. The exciter is a separate unit of sufficient capacity for a duplicate alternator, for which provision has been made in the power house.

The Power Company are at present installing additional 125 street lamps. An order has also just been placed for a second machine of 75 kw. capacity which will be installed in the old power station and will be used for light load service as it is the intention to give a 24-hour supply. All the electrical equipment has been supplied and the new generator will also be furnished through Messrs. Kilmer, Pullen & Burnham, of Toronto.

The Dealer and Contractor

The Architect vs. The Contractor

There are no two classes of workers more intimately associated than the architect of a building and the contractors for the various items of construction work. This is equally applicable to the Electrical Contractor who frequently hinders and whose work is often delayed by that lack of cooperation and understanding which works for efficiency and promptness in building construction. A number of points in this connection are nicely brought out by an architect, Mr. Louis R. Christie, in a recent issue of The National Electrical Contractor. Mr. Christie writes as follows:—

Frequently there is that different point of view between architect and contractor which puts a variable interpretation upon the work of the latter, his manners and his methods of doing business. There should be no difference of opinion—but there often is. Architects as well as contractors should be broadminded, wide gauge fellows who know what is what, and can render decision unbiased and uninfluenced by personal interests, but unfortunately like other professions, this one contains some cranks.

Nevertheless, you will find the majority of architects doing business on sound business principles. "Whatever is right is right" will be found the motto of most offices and contractors may be sure of a square deal as a rule.

When there is friction between architect and contractor you will find (according to the architect) that the trouble lies largely with the contractor; in the eyes of the contractor the fault lies with the architect. Many times the contractor is solely to blame. To appreciate this let us consider just what the architect stands for—what his duties are and what an owner should expect from him.

In the first place an architect is hired by the owner to get a good job. This is the paramount consideration—that the work be well done. An owner can forgive his architect if the design of his building isn't quite up to the highest standard of art, but he will never cease to regret having employed him if mortar falls out from between the stones in the foundation, or if the plaster cracks, or insulation of electric wires dries up and disintegrates and there is continual trouble from short circuits.

Now in order to get this first-class work in all branches of the building trades, every contractor knows that vigilance is required. No matter how square a contractor may be, he is at the mercy of his men. When the contractor's back is turned, careless workmen can slip in any amount of slip-shod work, almost certain to cause trouble later on, and yet the bad work may not be discernible from the good and neither architect nor contractor is aware of it until trouble ensues.

You must not expect the architect to put his finger on every piece of faulty construction in the building. His duty in supervising is done when by ordinary inspection he is able to pass upon the quality of work that appears to prevail. Neither should you expect him to stand on the job and show the men how to do their wiring. That is a job for the boss, and I must confess it is a job that some bosses neglect, especially those who leave everything to their foreman and do not check the work personally.

Contractors should realise also, that the quality of work which they and their employees do on the job is not everything. The way they handle their work is quite as important, for like every other business man, contractors are selling not merely executed work, but service. It makes a lot of difference to the architect whether the contractor handles his work promptly—efficiently—with least annoyance or not. To do good work is not enough if the entire running of a job makes trouble.

Three architects at lunch the other day were discussing the relative merits of certain electricians. Said one, "Collins is a tip-top fellow, as honest as the day is long. He has every intention of following specifications and his men are thoroughly reliable, yet do you know, I believe I'll have to stop his figuring in my office." "Why so," said the second. "He's so careless," replied the other. "Now here's a sample—I go on the job and discover that four or five wall outlets in a room which is to be panelled are set so low that when the carpenters come along to put in their panels the outlets will have to be moved. Collins very good naturedly moves them after considerable delay. Then I find the wrong kind of switches being put in, and an outlet or two left out in one room and a couple more located in the wrong place in another, notwithstanding that the plans and specifications are correct and specific."

Good Natured but Incompetent

"Now," he went on, "Collins doesn't do these things intentionally. The whole trouble is caused by his not watching the work himself, to see that it is right. He seems to think that it is the place of an architect to see that the wiring is correct; he thinks he can fall back on me—that I will keep his work straightened out and he need not watch it particularly himself."

It is surprising to find this attitude among contractors—men who have every intention of being square in all particulars, but careless put it up to the architect to run the job. There is no vocation where efficiency is more necessary than in the electrical trade. Considerable ingenuity is required in locating outlets so that they will not interfere with trim or doors. Plenty of patience is needed to see that conduits are extended with minimum of cutting. The trouble with electrical work is that faults do not show up until the carpenters come to trim the building—sometimes not until the building is completed. First thing you know a piece of trim goes slap over an outlet—or when it is too late, it is found that an outlet does not come in the center of a panel or in a bedroom outlets in a pair are placed to close to permit of the dresser being located between. Then there is a lot of fussing and changing.

But to return to our three architects and their conversation (which I can assure you is not imaginary, because I was there and heard it); "You will find Henderson a dandy electrician," said the third architect, "and I advise you to

have him do some of your work. Here's the way he handles mine; to begin with, when I ask him to figure he always gets in his bid promptly; it is typewritten and clear so you don't have to take a day off to ferret out what he is driving at. Next, if he is awarded the contract, he sees that a set of plans and specifications is given him and these are studied until he knows the job from beginning to end."

"His next move," the architect went on, warming up, "is to find out exactly when I want him to begin work, and he is careful to make an appointment with me in advance at the building to check over every outlet shown on the plan to see if any changes are to be made."

"Now the next thing on the programme," said the architect enthusiastically, "is entirely original with this man; I never saw it done before though I wonder why other contractors do not adopt the same custom. After approving the location of every outlet, Henderson has his foreman mark their position on the building with blue chalk, then I chase the owner around to approve them and the job is ready for his man to start work. You have no idea what a help this chalking up of outlets is to owners who do not sense their location until they see them marked in this manner. Often it saves many annoying changes later."

They Noted His Address

The other two architects entered in their note-books the name and address of the electrician who had made such a hit by his efficiency, and I have no doubt by this time he is securing work from them simply as a result of that conversation.

"When you get right down to it," said another architect to me recently, "if contractors would only realize what a boon it is to a busy architect to have his jobs go right along in a systematic way, they would be more careful in supervising of their own work. I'm thinking of a firm of plumbers we have been obliged to cut off from our contractors' list simply because every job they undertook put an extra strain on my office. This firm is honest enough, but both partners are so careless that someone must check them up to make sure they don't build a water closet in the parlor. They are perfectly willing to make everything right, but it takes a lot of supervision from us to head off their careless mistakes."

I went to a building recently to start the electrical work and there wasn't a sign of either plans or specifications on the job. The foreman asked me to locate the outlets for him. Where are your plans? I asked. He had none. How do you expect me to remember where outlets are and locate them without plans? Well he didn't know, but his boss had told him that Christie could show him where the outlets were to be. This is a thumb-hand way of doing business, and bound to annoy any architect. There is often so much trouble over the little details of electrical work that by the time the architect gets his building finished and the owner has moved in, the architect is about ready to give up his profession and go into some other business. Much of the trouble may be an architect's own fault by not keeping in close touch with the job—or sometimes, a job is let at too low a figure to some cheap-skate electrician, after which, of course, there is bound to be trouble—but you will frequently find that annoyance is caused by the busy electrician who, loaded up with contracts, expects too much of the architect.

Control of Stationary Suction Cleaners

The diagrams herewith indicate the wiring arrangements for an alternating current under motor operating a suction cleaner or other similar equipment under automatic control. The diagrams cover single, two and three phase and the motor may be controlled from any number of remote points of which four are shown in the diagrams. Fig. 1 is designed primarily for a three-phase current but may be operated single-phase by omitting the central wire. Fig. 2 can be operated two-phase either three or four wire as indicated. The type of remote control illustrated in these drawings is such that the motor may be started or stopped from any one of a number of points, but if a switch at any one point has been turned into the "on" position so that the motor is running, the turning of the switch at any other point will stop the motor. In our next issue we shall illustrate a simple arrangement by which the opening or closing of a switch at any point does not interfere in any way with the condition which may have been produced by any other switch, i.e., if the motor is already operating as the result of one switch being turned in the "on" position the turning "on" or "off" of another switch does not affect the motor.

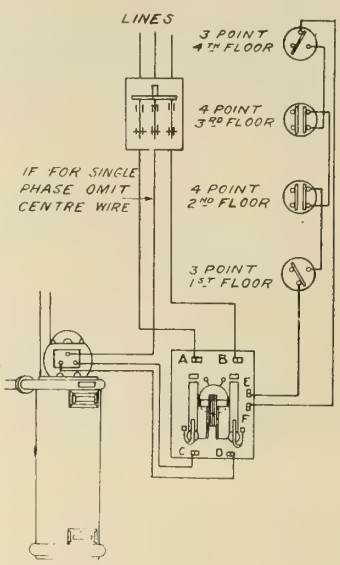


Fig. 1.

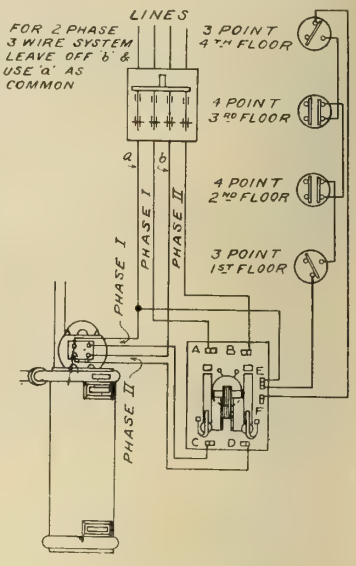
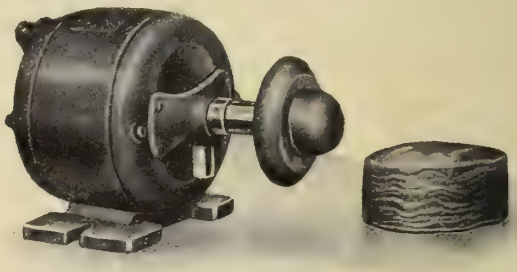


Fig 2.

Small Motor Applications

Almost all machines operated by hand or foot power require less than one-quarter h.p. Such machines are far too numerous and diversified in form to enumerate here, but a few of the more important are: sewing machines, washing machines, bench drills, marking machines, house pumps, dental drills, buffing and grinding machines, air pumps and



Domestic Buffing and Grinding Motors—1/30 H.P.

blowers, folding and wrapping machines, cigar and cigarette rolling machines, cleaners, planing machines; all classes of small industrial machines.

To operate such machines, the Canadian General Electric Company have developed a complete line of fractional horse power motors for all commercial circuits, comprising

sizes varying from 1/50 to 1/4 h.p. inclusive. The frames of these motors are made of drawn steel, in place of a cast framework. This method gives an exceptionally neat and compact construction, and at the same time, by its reduced thickness and weight, serves to decrease the temperature of

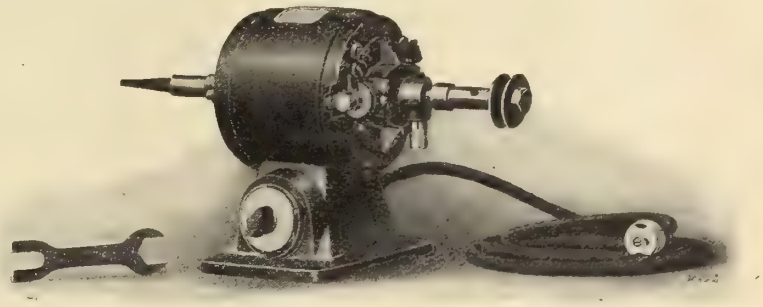


Commercial Buffing and Grinding Motors—1/8 H.P.

interior parts. The stator punchings are assembled in the drawn shell between two sets of spacing rings. The open edge of the shell is then rolled over the punching under heavy pressure. This cylindrical frame may be used with any special method of support, or may be attached to the standard flat base casting, or to a sliding base. The bronze bearing linings of all these motors are lubricated by underfeed oil cups, or oil ring bearings, depending on the size and duty to be performed.

All single phase motors have a simple and reliable starting switch, assembled within the motor frame. This switch automatically opens the starting phase of the field winding when the motor approaches full speed. Single phase motors can be supplied with clutch or clutchless armatures. The nature of the load must be carefully considered when deciding whether a clutch or clutchless motor should be applied. Machines requiring automatic and periodical reversal with considerable inertia to overcome during reversal, should as a rule be driven by clutchless motors. Loads having high inertia at starting, but not calling for reversal after being put in operation, are usually well operated by clutch armature motors. Both the foregoing requirements demand motors with high starting torque. Blowers, fans, etc., can frequently be operated with satisfaction by using clutchless motors having light load starting characteristics. Since no hard and fast rules can be laid down to govern the application of these small motors, each case must be studied very carefully, to determine properly the choice of motor. For special duty, motors can be made up with totally enclosing covers. Standard motors will operate satisfactorily on circuits where the variation of either frequency or voltage does not exceed 5 per cent. For a.c. motors, the full load speed is approximately 5 per cent. less than the synchronous speed, and for d.c. motors, the actual operating speed may be 5 per cent. above or below the rated speed. All C. G. E. drawn shell motors are rated by the actual h.p. they develop at the pulley, and not on the input expressed as horse power. The latter method is very misleading, since a motor rated, for example, at 1/8, and having efficiency of 50 per cent., would actually develop only 1/16 break horse power. The starting currents of the single phase motors with clutches are approximately three times normal full load values, while the starting currents of motors without clutches (i.e., with solid armatures) are approximately five to six times normal full load rating.

The following average values, taken from a series of



Jewelers' and Dentists' Buffing and Grinding Outfits 1/10 H.P.

tests will serve to illustrate the salient characteristics of these motors:

Tests at 60 cycles, 110 Volts, single phase

	Running Free			At Full Load		
H. P.	Amps.	Watts	Speed	Amps.	Watts	Speed
1/30	0.67	25	1790	0.75	55	1730
1/15	1.10	35	1790	1.40	100	1700
1/10	1.70	50	1790	2.00	140	1700
1/8	1.95	50	1790	2.20	165	1720
1/6	2.00	50	1790	2.60	190	1750
1/4	2.86	70	1790	3.75	275	1740

Tests at 110 Volts, Direct Current 1700 (Rated Speed) Shunt or Compound Wound

	Running Free			At Full Load		
H. P.	Amps.	Watts	Speed	Amps	Watts	Speed
1/30	0.25	27.5	2000	0.45	49.5	1750
1/15	0.26	28.6	2120	0.78	86.0	1780
1/10	0.27	29.7	2100	1.25	137.5	1730
1/10	0.36	40.0	1850	1.20	132.0	1650
1/8	0.37	41.0	2070	1.38	152.0	1730
1/6	0.39	43.0	2100	1.88	206.0	1650
1/4	0.55	60.5	2080	2.45	269.5	1715

The Canadian General Electric Company at present list several hundred different motors between 1/50 and 1/4 h.p., for various circuits and classes of duty.

Boving & Company of Canada, Limited

The business of the Canadian Boving Company will in future be operated under the title of Boving & Company of Canada, Limited, so as to bring this branch into line with the branches of Boving & Company, Limited, London, operating in various other parts of the world. At the same time it is announced that owing to the great increase in the volume of the Canadian business and to their having purchased the works of the Madison Williams Manufacturing Company of Lindsay, Ont., the capital of the company has been increased to one million dollars and the scope of their manufactured articles has been somewhat enlarged.

This company are now in a position to turn out from their Canadian works the following machinery:—Water turbines, centrifugal pumps, pulp and paper making machinery and saw mill machinery. Of these the centrifugal pumps have in the past been made in England, the water turbines, pulp and paper making machinery in Sweden and the saw mill machinery by the Madison Williams Company of Lindsay.

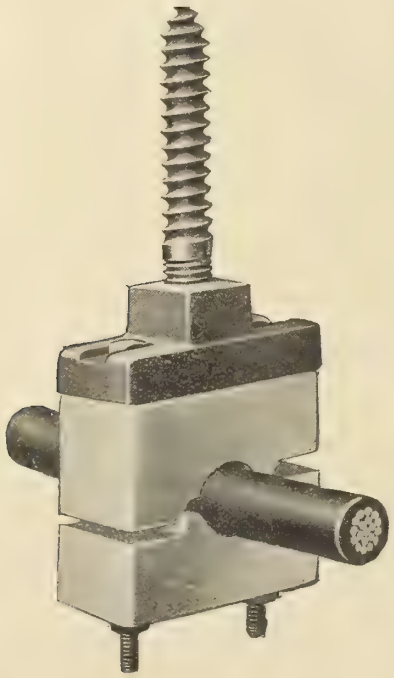
The Canadian Boving Company completed their first large installation in Canada in 1910 when they supplied water

turbines of some 8,000 h.p. capacity for the Calgary Power Company. Other orders up to that time and since that date include the city of Winnipeg seven units, totalling 29,900 h.p.; the Sydney Power Company, Trenton, eight units, totalling 10,800 h.p.; the Chicoutimi Pulp Company; the town of Farnham, P.Q.; the town of Welland; the St. Francis Hydraulic Company, D'Israeli, P.Q.; the Carillon Development & Construction Company; the city of Penticton; the Ocean Falls Pulp Company. The above orders were all for turbines. Centrifugal pump units have been supplied to the city of Toronto; the Nipissing Mining Company; Montreal Water & Power Company; the town of Welland; Delta municipality; the city of Moose Jaw; E. B. Eddy Company, Hull; city of Prince Albert; town of Preston.

The experience gained during the past three years by the Canadian Boving Company has enabled them to gauge the Canadian markets and familiarize themselves with the requirements of it. Working in close conjunction with the parent company, Boving & Company, Limited, London, Eng., it is certain they will be able to meet the needs of the Canadian market promptly and satisfactorily.

New Cable Hanger

A cable hanger to facilitate the hanging of feeders in mines, has recently been placed on the market by the Electric Service Supplies Company. These hangers are particularly designed for suspending feeder cables in mines, but are adaptable for use in various other locations. They are used for hanging cable of from ½ to 1 inch in diameter, inclusive, and permit the placing or removal of the cable after the



Cable Hanger for Mines.

hanger proper has been permanently installed. As shown in the illustration they consist of two split porcelain insulators, notched and fitted together to receive the cable and clamp it squarely. These porcelain insulators are bolted together—the bolts extending through the cast-iron head, which is specially designed to afford easy installation. The clamping surface of these insulators is ribbed to prevent any tendency the cable may have to slip through the clamp and damage the insulation.

These hangers are fitted with lag screws 3 inches long, for use in connection with wooden plugs. For timber work a special lag screw of the same length is furnished. They may also be supported by special expansion bolts. The hangers are 3¼ inches wide and 4½ inches high, exclusive of the lag screws or expansion bolts. All metal parts are heavily galvanized to effectually withstand the action of rust. Every part of this cable hanger is designed to meet the most excessive service, and to afford an easy means for hanging heavy cable.

Trade Publications

Annual Report—The twenty-seventh annual report of the Commissioners for the Queen Victoria Niagara Falls Park, covering the operations for the year 1912, is to hand.

Electrical Specialties—1913 catalogue issued by the Chelten Electric Company of Philadelphia, describing the principal house wiring specialties manufactured by this firm. This company make a specialty of push button switches and receptacles.

Fans—Ad book No. 30 issued by the Canadian Westinghouse Company, Hamilton, describing their fans and the multitudinous uses to which they may be put during the hot season. This company manufacture fans of all sizes and suitable for all operating conditions.

Turbines and Centrifugal Pumps—A comparison between low pressure water turbines and centrifugal pumps, and the inferences therefrom applied to the construction of irrigation and drainage installations, published by Escher Wyss & Company from their Montreal office.

Solderless Connectors—The 10th yearly catalogue issued by Dossert & Company, descriptive of Dossert Solderless Connectors for solid and stranded wires. In the preparation of this catalogue the different types of connector and the use to which each may be put are fully described. The catalogue is very completely illustrated.

C. G. E. Publications—Bulletin No. A4119 issued by the Power & Mining Department of the Canadian General Electric Company dealing with the application of electricity in the packing industry. Bulletin No. A4110, issued by the Supply Department, entitled Cloth Pinions; pamphlet No. 480B describing the C. G. E. flatiron; No. 482-B on Luminous Radiators; and No. 503 illustrating and explaining the construction of type "H" form "K" transformers.

Glover's Almanac—W. T. Glover & Company, Limited, of Trafford Park, Manchester, Eng., have just issued their 12th almanac, for the year beginning July 1st, 1913. The almanac, as heretofore, is compiled with the idea that much useful information is contained in the technical items chiefly dealt with, and which the busy engineer has not time to refer to in the ordinary way. This calendar contains a reference for each day which will be found both interesting and instructive in every instance.

Telephone Equipment—Pamphlets 41 and 42 issued by the Stromberg-Carlson Telephone Manufacturing Company describing central energy telephones and standard local battery telephones including wall and desk and combination types. No. 41 describes all the reliable standards and some new telephones in connection with which, during the past year, many improvements have been made in design and quality. No. 42 describes fully all the standard local battery equipment in which some important improvements in the No. 896 type compact wall telephone are noted.

The Oshkosh Manufacturing Company are distributing a little six-page booklet on pole line anchors. This booklet fully describes in detail the new Oshkosh Patent Anchor.

Current News and Notes

Amherst, N.S.

The contract for extension to the South Park street transformer station of the Maritime Coal, Railway & Power Company of Amherst, N.S., has been awarded to Messrs. Rhodes, Curry & Company.

Aurora, Ont.

By a vote of 420 to 19 the town of Aurora endorsed the agreement whereby the Toronto & York Radial Railway Company agree to supply power at $25.50 per h.p. year. This is a five-year contract renewable at the end of that period. The company delivers current at 4,200 volts for power and 2,300 for lighting purposes.

Ayr, Ont.

By-law will be voted on July 21st authorizing Council to get estimates from the Hydro-electric Power Commission of Ontario.

Bright, Ont.

By-law will be voted on July 21st authorizing Council to get estimates from the Hydro-electric Power Commission of Ontario.

Battleford, Sask.

The report that current will be supplied to this town by the North Battleford plant is not correct. Battleford has now in course of erection two 200 kv.a. Westinghouse generators to be driven by Mirrlees-Diesel engines. The possibility of interruptions during the change in equipment no doubt led to the report.

Carlyle, Sask.

Tenders are called to August 1st by the John Galt Engineering Company, Winnipeg, for power house and reservoir, pipes, pumping system, steam pump, two boilers and stack, vertical steam engine, generator, exciter and switchboard, poles, copper wire, meters, transformers, tungsten street lighting, etc.

Chignecto, N.S.

The contract for an extension to the electric power station of the Maritime Coal, Railway & Power Company, at Chignecto, N.S., has been awarded to Mr. J. N. Page, Amherst. Steam and electrical equipment will be required.

Drumbo, Ont.

By-law will be voted on July 21st authorizing Council to get estimates from the Hydro-electric Power Commission of Ontario.

Edmonton, Alta.

Contracts have been awarded to The Edmonton Construction Company, 623 2nd street, and to Hulbert & Wilson Company for extensions to the Edmonton municipal telephone system.

Estevan, Sask.

Tenders will be called shortly for the construction of a new municipal power house. Chipman & Power are engineers.

Fort Frances, Ont.

The private local telephone company, represented by Mr. P. T. Roberts, recently submitted an offer to sell their system to the town for $5,000. This offer has been accepted by the council and a by-law will likely be submitted to obtain the necessary authority.

Flett Springs, Sask.

The Flett Springs Telephone Company has awarded contracts to the Northern Electric & Manufacturing Company for apparatus for a new system.

Goderich, Ont.

The Town Coucil contemplates installing a lighting system for park and all bridges.

A fire alarm system to cost approximately $1,700 is contemplated.

Grenfell, Sask.

A by-law was voted on July 4th to raise $15,000 to erect an electric plant. The British Canadian Engineering & Supply Company will get the contract.

Grandmere, Que.

Work has been started on the Cofferdam and power house to be erected by the Laurentide Company, Limited, at Grandmere, Que.

Lindsay, Ont.

The Bell Telephone Company are at work installing their wires underground on Kent and William streets.

Montreal, Que.

The Canadian British Insulated Company, Montreal, have received an order from the Quebec Railway, Light, Heat & Power Company for 14 cables ranging from 600 volts to three-phase, 23,000 volts. The cables, which are to cross the St. Charles River, are of the paper-insulated, lead-covered, double steel wire armoured, submarine type.

The Montreal Tramways Company have commenced work on the new routes approved by the Council. Some of the small changes are now nearly finished, but it will be between two and three months betore fhe important routes are available owing to the impossibility of obtaining intersection work. The main object of the plans is to relieve the congestion at the rush hours.

The Cook Construction Company, Sudbury, Ont., have been awarded the contract for the enlargement of the Montreal aqueduct at $2,322,562. This will enable 10,000 horsepower to be generated, 4,000 of which will be utilized for a city lighting scheme.

Through the kindness of Mr. Brown, chief engineer on the C. N. R. Mount Royal tunnel, members of the Montreal Electrical Society recently visited the tunnel and inspected the construction operations. The party were met by Mr. Lancaster, the electrical engineer, and were taken through the section of the tunnel from the western portal to the Maplewood shaft. The company have installed electrical machinery for carrying on the work, including three transformers 11,000/2,200 volts; three 2,200 volt motors for driving air compressors, rated at 1,100 cubic feet of free air per minute; one 2,200 volt motor, direct connected to a fourth compressor, with a capacity of 2,200 feet of air per minute and one rotary converter, 2,200 volts a.c. to 250 v. d.c. for the trolley line.

The Canadian Westinghouse Company, Hamilton, Ont., have recently purchased three engines from the International Engineering Works, Limited, for direct-connection to alternating current generators for the Canadian Pacific Railway. The Canadian Explosives, Limited, Montreal, P.Q., are to install two 14 by 18 Robb Corliss engines direct-connected to 125 kv.a. electric generators.

It has been definitely decided by Stone & Company, Limited, Deptford, England, manufacturers of electrical specialties, including the Stone system of car lighting, to establish a factory in the province of Quebec. The location, however, has not yet been settled. At first the accumulators will be constructed here, and eventually the complete apparatus

will be manufactured in Canada. The company have had an agency in Montreal for four years, and have installed their system on the C. P. R., G. T. R., C. N. R. and other Canadian lines.

Mr. J. J. Creelman has been appointed lecturer in railway economics at McGill University. Mr. Creelman is well known in electrical circles, being a director of several Canadian electrical companies.

The City of Montreal have given permission to the Bell Telephone Company to open 46 street sections for the construction of underground conduits. This is subject to the deposit of a sum of money sufficient to cover restoring these streets to their original condition. The company have also to reserve a duct in each conduit for the wires of the police patrol and fire alarm systems, and in addition must remove the poles when the conduits are constructed, except those absolutely necessary for distribution purposes.

By the declaration of a quarterly dividend of 2½ per cent. the stock of the Montreal Tramways Company has been placed on a 10 per cent. basis.

New Toronto, Ont.

On July 16th the ratepayers of New Toronto will vote on the question of closing a contract for the supply of current for light and power with the Hydro-electric Power Commission of Ontario.

Ottawa, Ont.

Application has been made to the United States Government for authority to regulate the flow of waters at the American Sault. The application is made by the Lake Superior Power Company. This reopens once more the question of the division of our international waterways in connection with which our Government and the Conservation Commission have found it necessary to be continually on guard. The question of diversion in this case will doubtless be referred to the International Waterways Commission composed of Canadian and United States representatives.

The members of the Ontario Railway and Municipal Board, with counsel and engineers have been making a personal inspection of the situation at Chats Falls, a water power the value of which will have to be decided by this board.

Prince Albert, Sask.

Tenders have been called for the construction of a new telephone exchange for this city to replace the present one which has outgrown its usefulness. It is understood that the automatic system will be installed of a capacity sufficient to accommodate 2,500 subscribers at the present time, and with an ultimate capacity of 3,000 instruments.

Plattsville, Ont.

By-law will be voted on July 21st authorizing Council to get estimates from the Hydro-electric Power Commission of Ontario.

Regina, Sask.

By a recent act of the local legislature it is now possible for municipalities to pay for their rural telephone systems by the issue of debentures instead of by cash payments as formerly. It is said that since the passing of the act 110 applications for incorporation have been received by the Government.

Russell, Man.

Contract has been awarded to C. D. Sparrow for the erection of a power house to accommodate Ruston-Proctor-Westinghouse gas producer units.

Sydney, N.S.

The Cape Breton Electric Company will extend its line to New Waterford and Florence, but it has not yet been decided just what course the line will follow.

Toronto, Ont.

Following recent interruption in the supply service due to breaks in the power line it has been recommended that this city instal an auxiliary steam plant.

Vancouver, B.C.

It has been announced that the Canadian Pacific Railway Company will proceed at once with the electrification of that part of their line between Castlegar and Rossland, B.C. The contract for the necessary electrical equipment has been let to the Canadian General Electric Company. 2,400 volt, direct current equipments are under consideration.

Welland, Ont.

On July 1st the town of Welland inaugurated their local hydro-electric service. The streets are illuminated by the ornamental tungsten cluster type standards.

Woodville, Ont.

A by-law was submitted on July 15th, authorizing the sale of debentures to the amount of $4,000 to provide for an electric distributing plant.

Winnipeg, Man.

Contract has been awarded to the Fort Garry Construction Company for an extension to the municipal terminal station on Rachel street.

Contract has been awarded to Vickers, Limited, Montreal and Sheffield, England, for manufacture, delivery and erection of three 5,000 kv.a. generators and auxiliary parts.

Tenders are received by the Board of Control till August 1st, for a 1000 kw. motor-generator set with accessories complete for King street sub-station.

The municipality of Fort Garry is negotiating with The Winnipeg Electric Railway Company to extend their present Park line through that municipality.

Moonlight Schedule for August 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
Aug 1	7 40	Aug 2	4 10	8 30
2	7 40	3	4 20	8 40
3	7 40	4	4 20	8 40
4	7 40	5	4 20	8 40
5	7 40	6	4 20	8 40
6	7 40	7	4 20	8 40
7	7 40	8	4 20	8 40
8	7 30	9	4 20	8 50
9	7 30	10	4 30	9 00
10	10 10	11	4 30	6 20
11	11 00	12	4 30	5 30
13	0 00	13	4 30	4 30
14	1 00	14	4 30	3 30
15	2 10	15	4 30	2 20
16	No Light	16	No Light	
17	No Light	17	No Light	
18	No Light	18	No Light	
19	7 20	19	9 30	2 10
20	7 20	20	9 50	2 30
21	7 20	21	10 10	2 50
22	7 20	22	13 40	3 20
23	7 20	23	11 00	3 40
24	7 10	24	11 40	4 30
25	7 10	26	0 20	5 10
26	7 10	27	1 20	6 10
27	7 10	28	2 30	7 20
28	7 10	29	3 50	8 40
29	7 10	30	4 40	9 30
30	7 10	31	4 40	9 30
31	7 00	Sep. 1	4 50	9 50

Total Hours 175 40

TEN POINTS of EXCELLENCE

1. The scale is uniform throughout the entire range of deflection.

2. The readings can be made with practically the same precision on violently fluctuating loads as on steady loads.

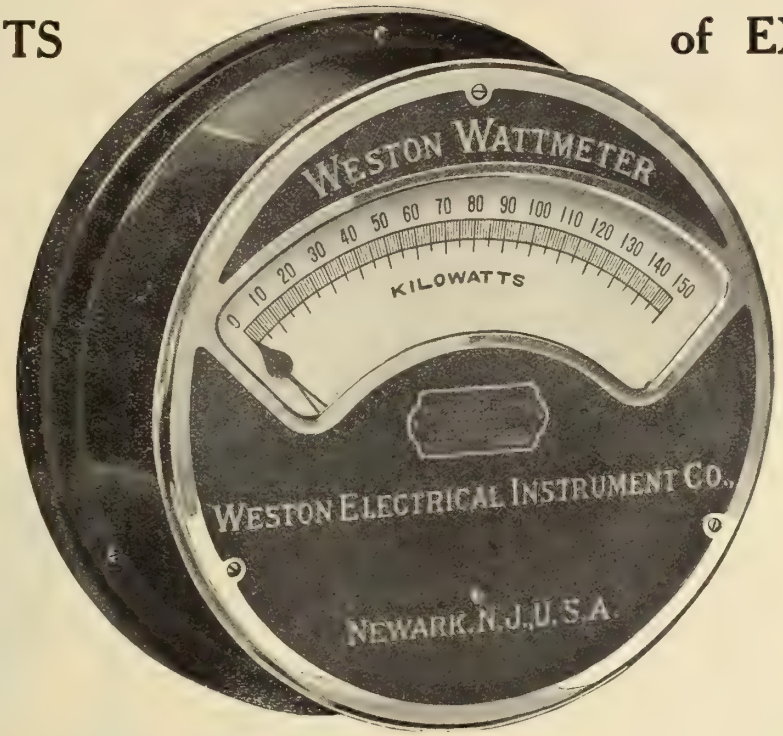
3. The indications are equally accurate on direct-current circuits or on alternating-current **circuits of** any frequency, power-factor or wave form within commercial limits. Therefore, these watt-meters can be calibrated with direct-current and used on alternating-current circuits without change of calibration.

4. The scale is flat and is therefore easily read.

5. The pointer is entirely free from vibration produced by mechanical resonance.

6. The power consumption is extremely small.

7. They have a large overload capacity, which will allow the measurement of full power at power-factors below 0.50.



8. They are far more reliable and durable than any commercial wattmeter heretofore built.

9. They are accurate within the limits of scale reading, regardless of changes in temperature, frequency, power-factor and wave form, within the range of commercial practice.

10. The zero position of the pointer can be adjusted from the outside without removing the instrument from the board.

In the **Weston Switchboard Wattmeter** every heretofore existing difficulty has been satisfactorily overcome by intelligent design and skillful construction and the results attained with these instruments are far in advance of anything ever accomplished in the art of commercial electrical measurement. Send for catalogue giving full information regarding **our complete** line of **A.C. Switchboard** Indicating Instruments, Voltmeters, Ammeters, Wattmeters, Synchroscopes, Power Factor Meters, Frequency Meters, also D.C. Instruments.

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Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 618 Union Trust Bldg.
Montreal, Winnipeg, Vancouver, Calgary } Northern Electric & Mfg. Co.
Toronto, 76 Bay Street.

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We specialize on making fixtures from original drawings on short notice.

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Condensed Department

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Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

FOR SALE

Lights			Speed
2	450	Gen. Elec. type C. form T, direct-connected to Curtis form A non-condensing turbine, 100 lbs. pressure, 25 kw., 125 volt.	3600
2	450	Gen. Elec., 6-pole, form L, 25 kw., direct-connected to Westinghouse vertical gasoline engines	350
1	540	Gen. Elec., 6-pole, form F, comp., 30 kw. direct-connected to 11 x 8 in. Gen. Elec. vertical marine type engine, 125 volt	305
1	1300	Northern, MP, 75 kw., comp., direct-connected to Racine vertical cross comp. engine, 125 volt	275
1	1300	Westinghouse, 6-pole, comp., 75 kw., direct-connected to 14 x 14 Ames auto, center-crank horizontal engine, 125 volt	275

Send for our "Monthly Bargain Sheet" showing complete list of machines on hand with net prices. Every machine sold is completely overhauled and fully tested at our works before shipment, and is sent out practically "as good as new."

We Buy, Sell, Rent, Exchange and Repair.

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Established 1893.

1601 S. Lincoln Street. 14-t.f.

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Electrical Engineer, single, age 28, desires change. Seven years construction and maintenance work, Generators, Switchboards, Transmission lines, etc. Box 821, Electrical News, Toronto, Ont. 13-14

Hydro-electric power house and central station construction foreman desires position on large construction work. Wide and thorough practical experience. Box 830, Electrical News. 14

For Sale

1500-light Dynamo, Exciter and Marble Switchboard, equipped with all attachments and instruments, all in first-class condition, for sale cheap; also one 13-inch LeFell Water Wheel, brass buckets, with wheel case, spur wheel and pinion. Box 819, Electrical News, Toronto, Ont.

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The Cooke System of Mechanical Car Ventilation. Specifications and estimates furnished. Manufactured in Canada under Canadian Patent 128070. Vacuum Car Ventilating Co., 561 W. Monroe Street, Chicago, Ill. 11 t.f.

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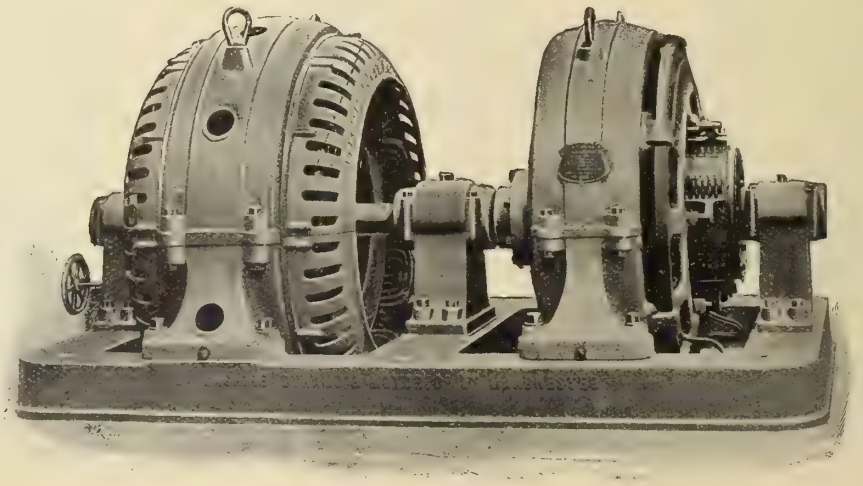
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Curve Drawing Meters. Portable Type for Factory Use

The "Lancashire" Ball Bearing Induction Motor



"Elliott" Electrical Instruments

Motor Generator—300 K.W. for Traction Service

The Lancashire Dynamo and Motor Co. of Canada, Ltd.

Montreal **Toronto**

Electrical Supplies of every description

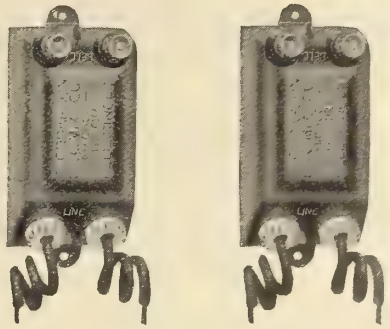
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Pass & Seymour Electrical Specialties
Carbon and Tungsten Lamps
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This new Thordarson product is encased in solid steel. Is fire, fool and moisture proof. Always works efficiently. Short-circuiting cannot impair them in the least. Current consumed will not register on an ordinary meter.

WRITE FOR FULL PARTICULARS AND NEW DISCOUNTS

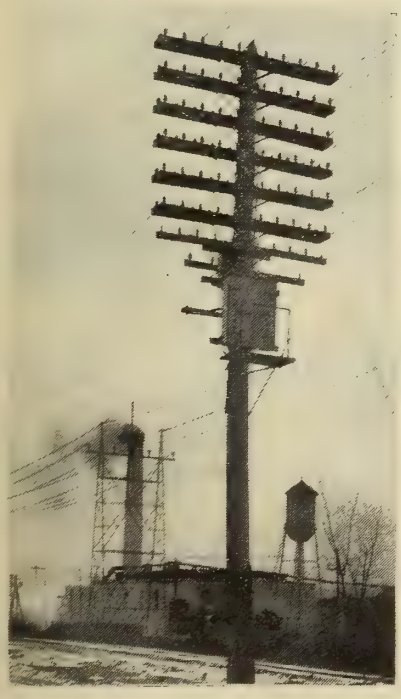
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Send us your specifications for

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shipped from some one of our 14 pole yards in Canada. Our Canadian Stocks are by far the largest and most complete.

May we quote you?

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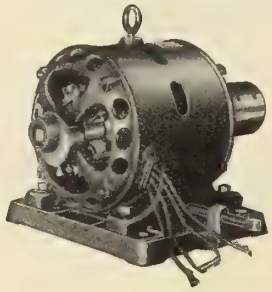
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Construction Supply Co., Toronto Representatives

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Satisfy the consumer because the closing of an ordinary knife switch, which the most inexperienced person can do, is all that is required to start them; they do not require expert attention to enable continued satisfactory results to accrue.



They make motor drive popular. 1/4 to 40 H.P. 25 to 140 Cycles. All with interchangeable voltage connections.

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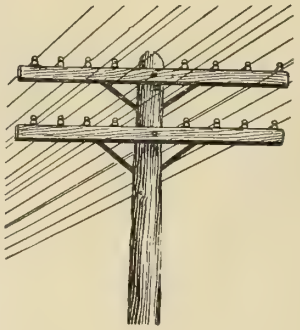
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We are now handling both Western Red Cedar and Northern White Cedar Poles. Write for prices. Quick shipments.

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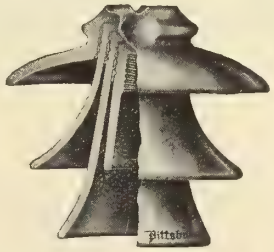
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THEY NEVER FAIL

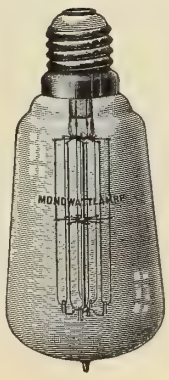
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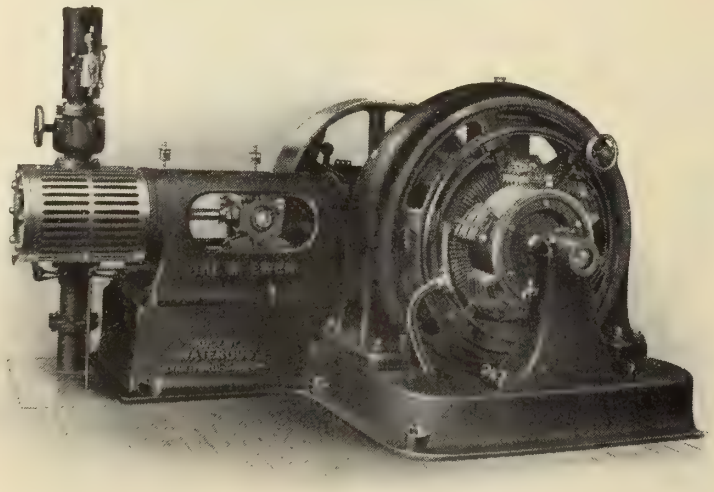
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Can that be said about **your** plant?

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Improve with use.

A simple and sturdy design—steam valves that are absolutely tight—a governor that permits of the closest regulation—an oiling system that gives perfect lubrication. These are some of the features which have placed McEwen Engines in hundreds of steam plants in Canada.

Send for the McEwen Booklet—it will interest you.

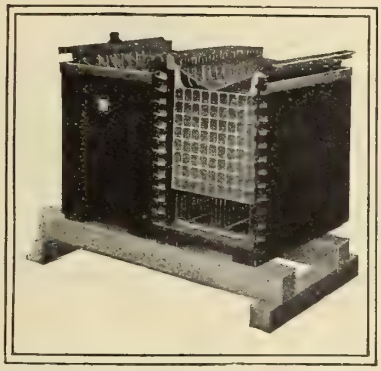
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CONTRACTORS to the ADMIRALTY and WAR OFFICE.

Street Illumination

By Multiples and Series

Pemco Fixtures

"The Practical Fixture"

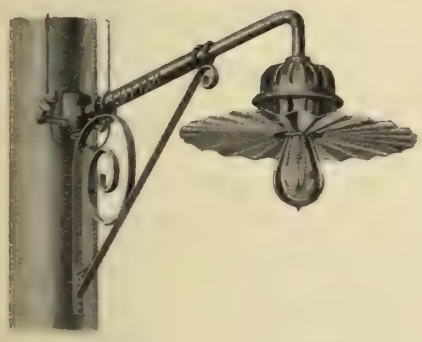
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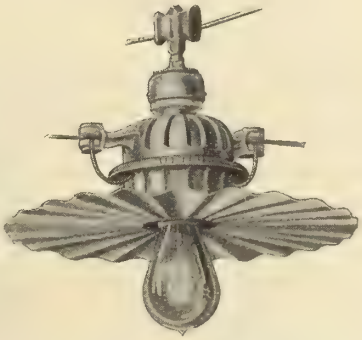
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Cutter Boulevard Telescope Bracket with One-Piece Fluted Streethood.

Substantial Construction
High Insulation
Easy to Install
Artistic Appearance

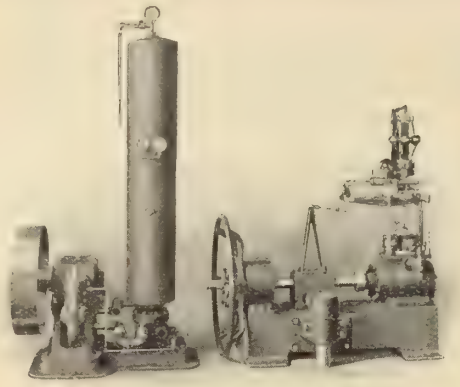


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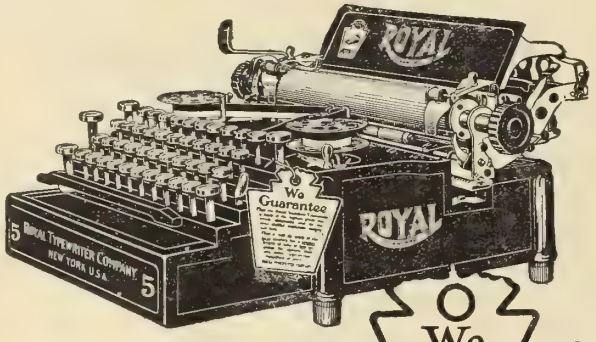
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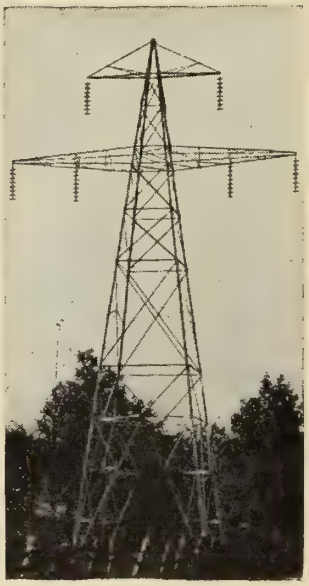
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DOUBLE CIRCUIT TOWER
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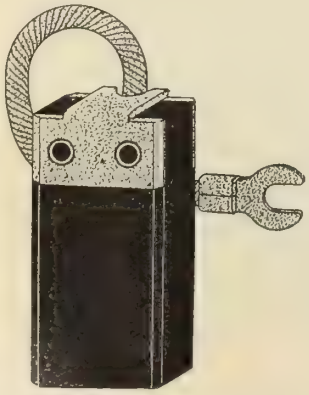
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Samples gladly sent

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Yager's Soldering Fluxes

4 Forms—1 Result—The Perfect Joint

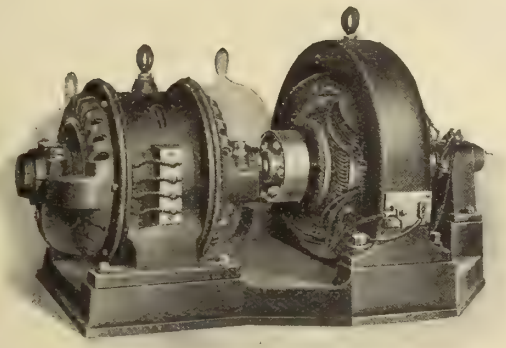
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When in need of any special electrical apparatus or repairs to defective motors or generators, write us. We are fully equipped.

Toronto & Hamilton Electric Company

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Mean Summer Profits ! !

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Electrical dealers should, fix up sample lamps—call on every user and sell him

CRESCENT COLORING FLUID

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Ornamental Street Lighting

Halt !

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CLEAR ROUGHED ALABASTER HALF OPAL AND HALF CLEAR

Globes made according to specifications

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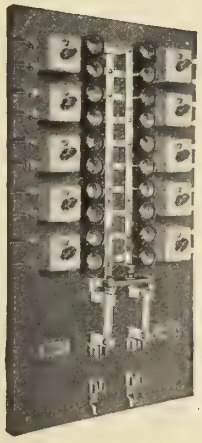
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SIMPLICITY
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EASE OF INSTALLATION



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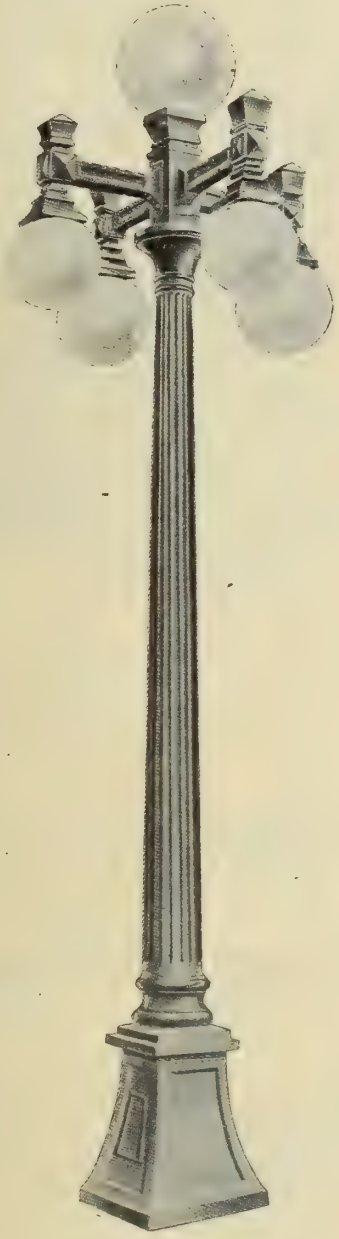
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Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company, 298 pages. Price 50c.

Electrical Engineering, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price $3.00.

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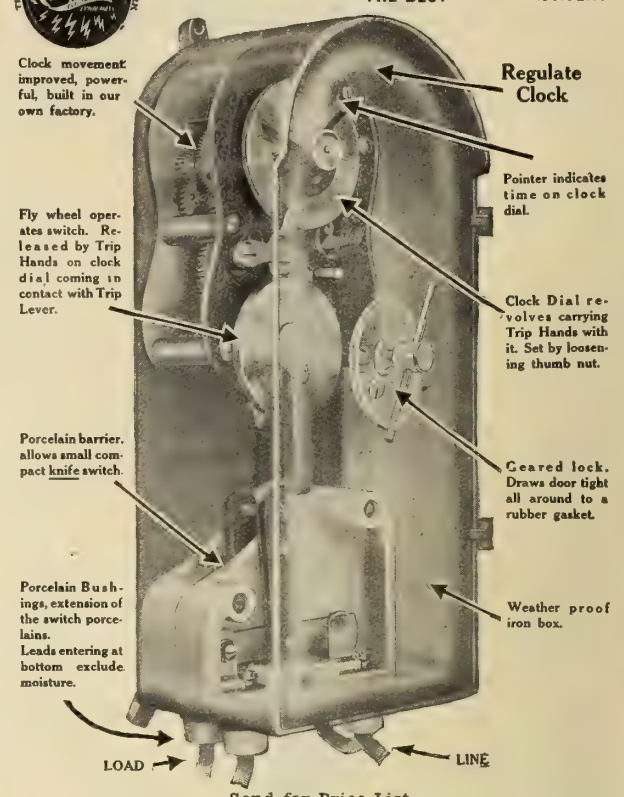
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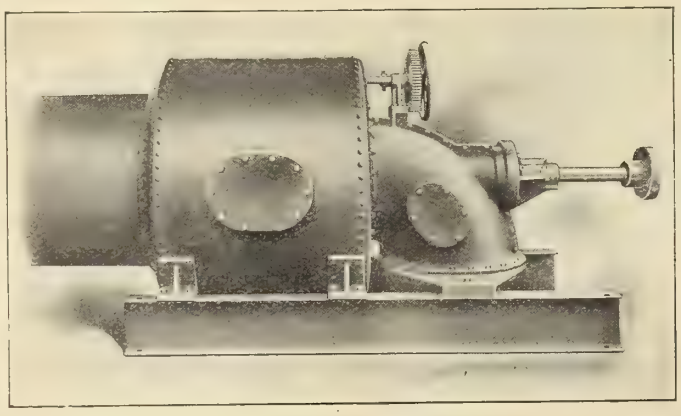
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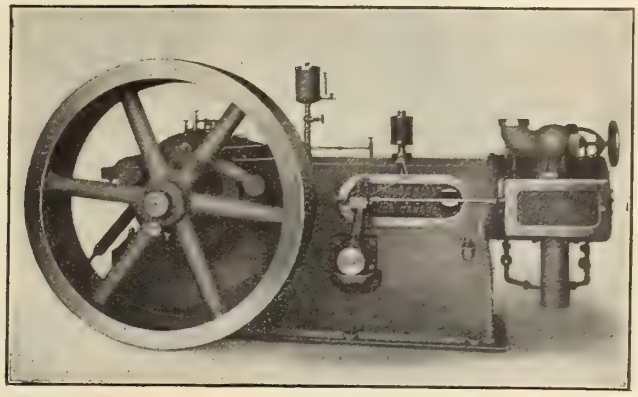
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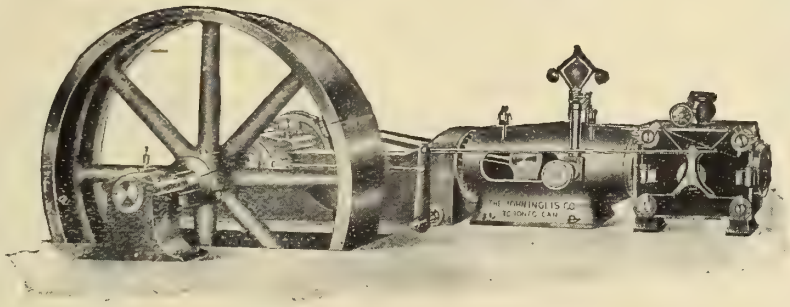
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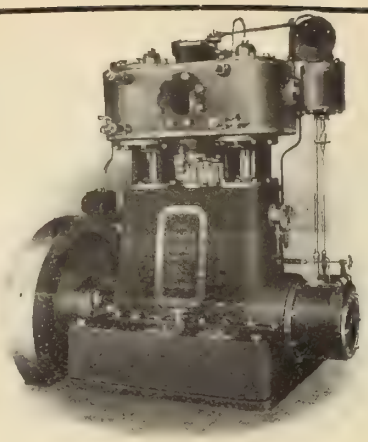
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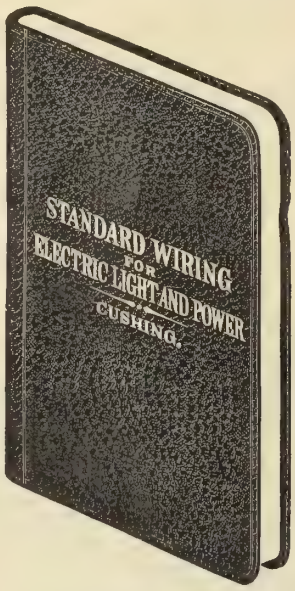
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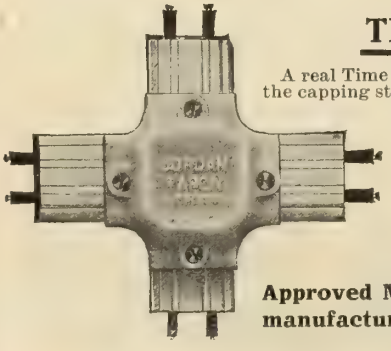
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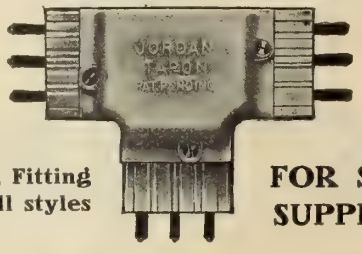
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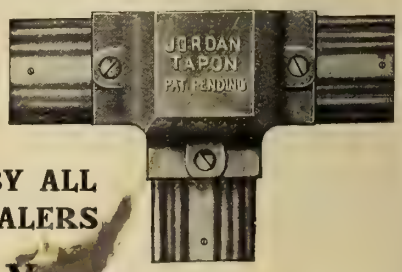
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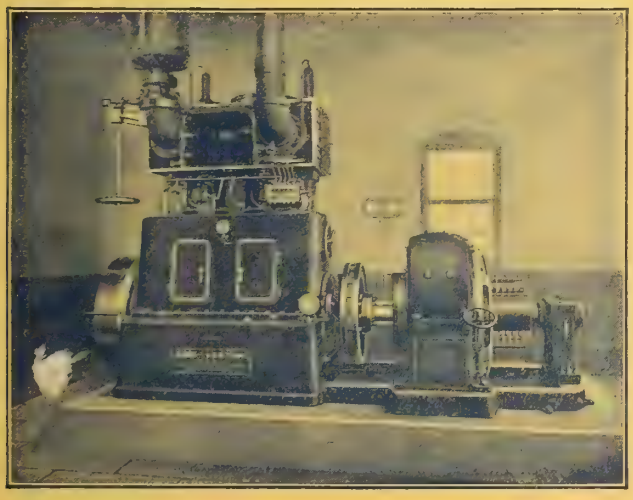
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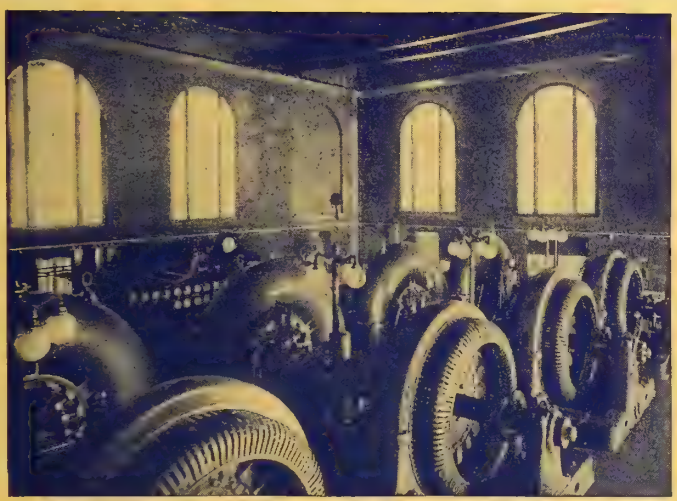




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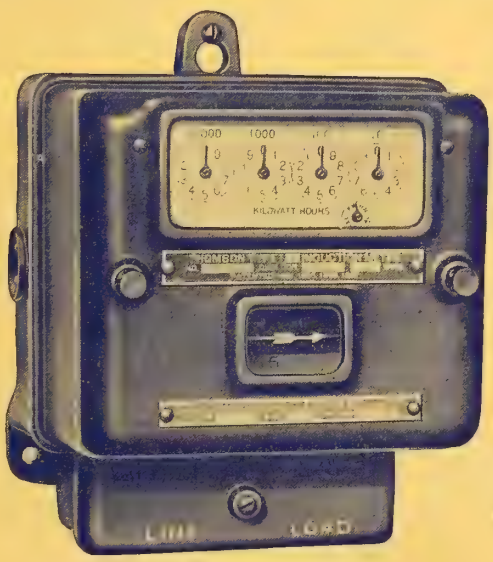
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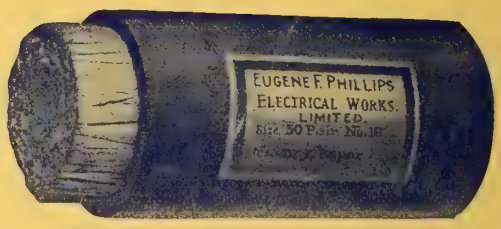
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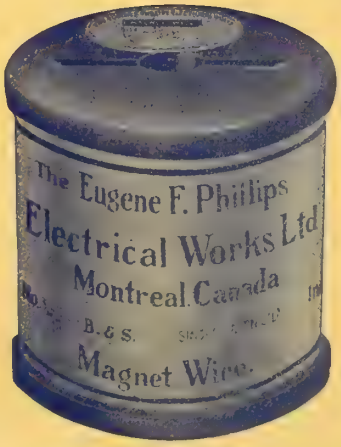
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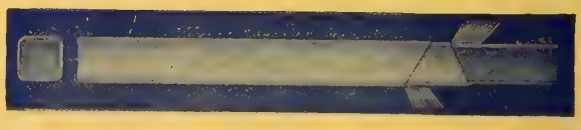


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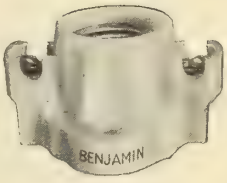
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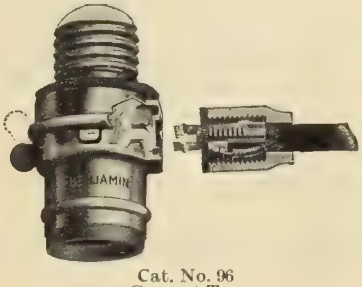
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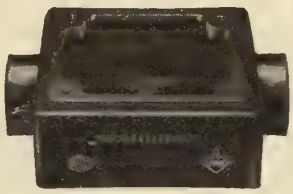
Railway Condulets



Type BLMC—For Bracket Lamp Outlets. Takes Round Base Fittings.



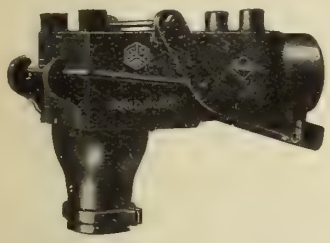
Type CLOC—For use with Centre Ceiling Fittings.



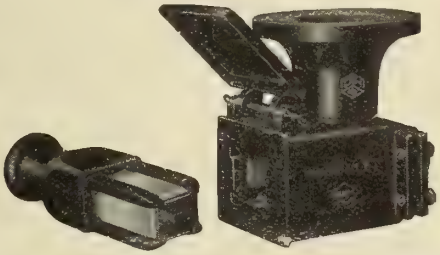
Type JRR—For use back of Mouldings with Rectangular Base Fittings.



Type DSOC—For Deck Sill Outlets. Takes Round Base Fittings.



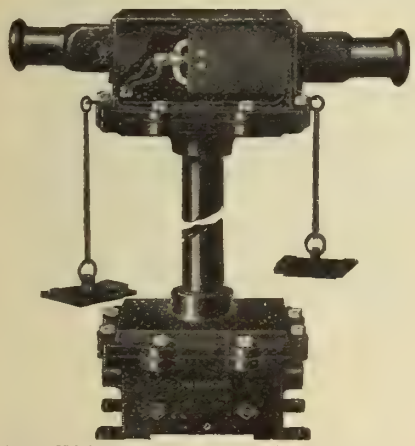
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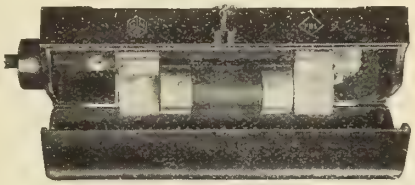


Type UGC—Arranged as Yard Charging Equipment for Underground Conduit System.

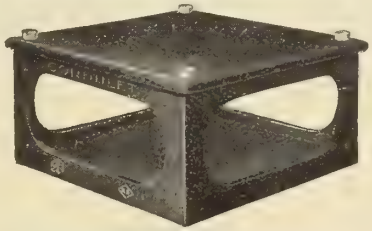


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City.....

Prov.....

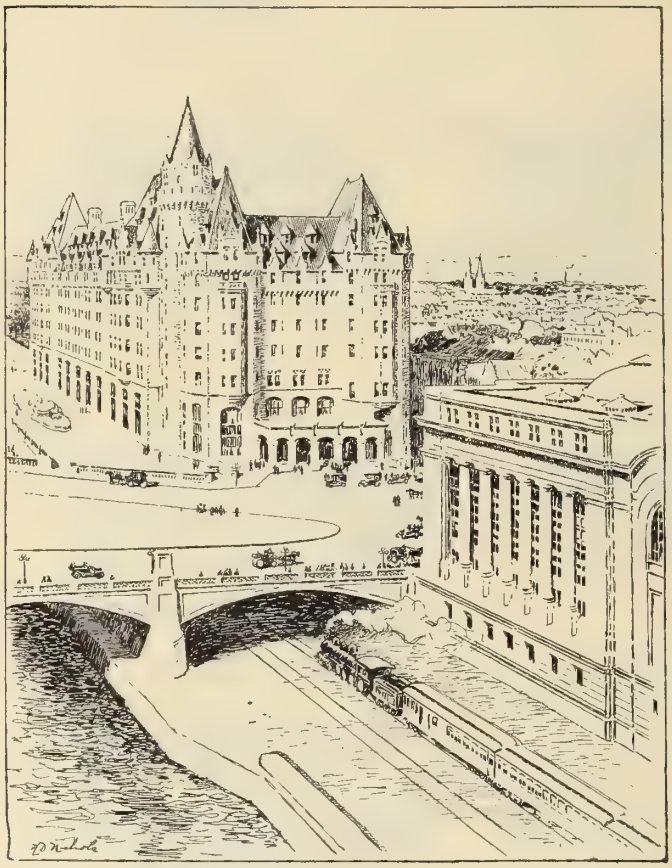
2713

Across Canada with the

IMPERIAL WIRE & CABLE CO.

LIMITED

Toronto - MONTREAL - Winnipeg



Second of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows

Chateau Laurier and Grand Trunk Central Station, Ottawa

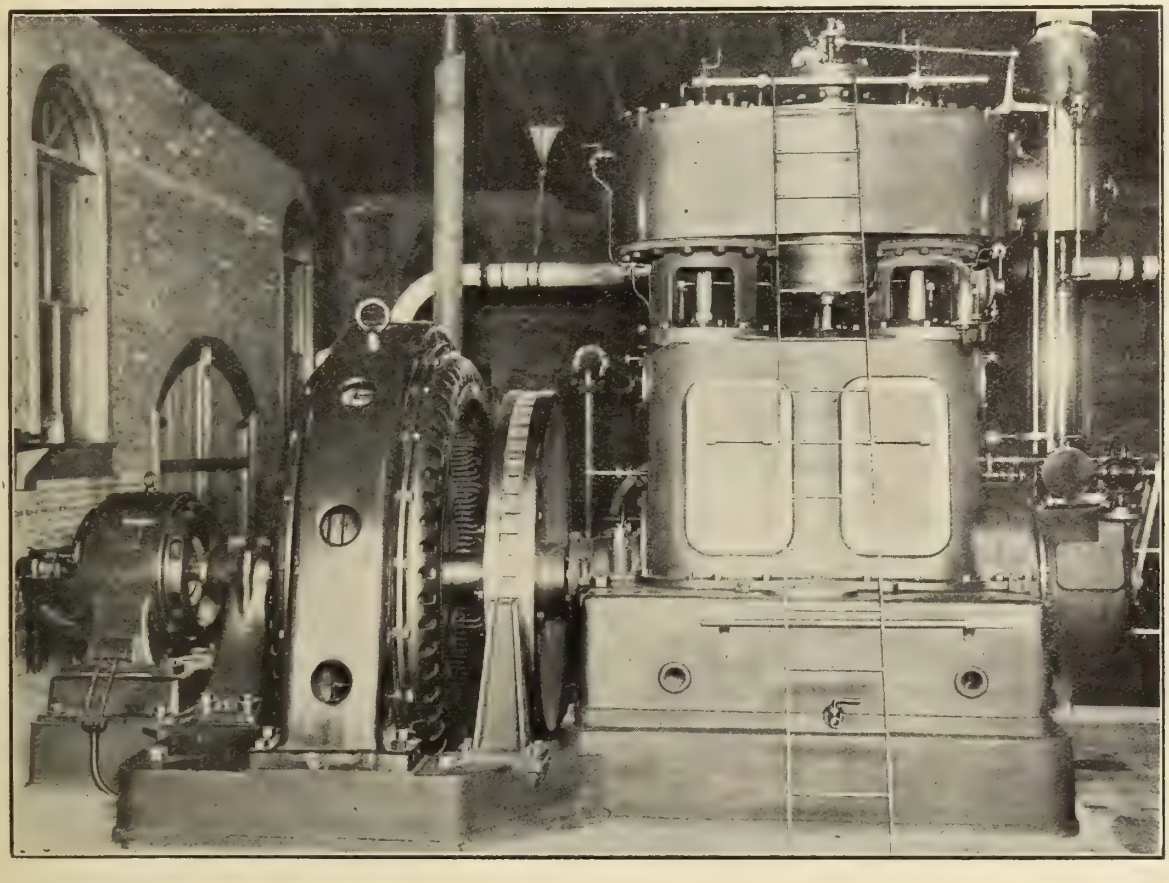
These buildings were wired throughout with "ADANAC" Rubber Insulated Wire

Architects: Ross & McFarlane, Montreal.
Engineers: Westinghouse, Church, Kerr & Co., New York.
Electrical Contractors: Western Electric Co., New York.

Address our nearest office, Montreal, Toronto, Winnipeg

Alberta and British Columbia enquiries may be addressed to our Sales Agents, Northern Electric & Manufacturing Co., Limited, Calgary and Vancouver.

High Grade Electrical Apparatus



375 K.V.A. 2300 volt 2 phase 60 cycle 360 R.P.M. A.C. generator direct connected to a Belliss & Morcom high speed engine supplied to the corporation of Wetaskiwin, Alta.

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR

The General Electric Co., of Sweden

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers



The C.P.R. Hotel at Calgary
A "GALVADUCT" Building

"GALVADUCT"
"LORICATED"

The popular conduit of the Canadian people used in most of Canada's largest buildings.

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated.

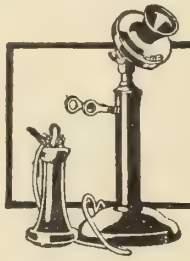
"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

Conduits Company, Limited

Toronto - Montreal



SAFEGUARD
YOUR SERVICE

THERE are more than 500 telephone "troubles" in Jacksonville every day due to telephone receivers being left off the hook.

Your telephone is reported "Busy" or out of order when the receiver is left off the hook, no one can call you and you are likely to suffer serious inconvenience.

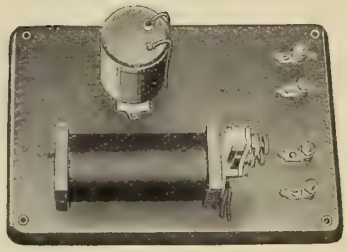
On duplex and party lines all telephones on the line are rendered useless when any one of the receivers is left off the hook.

When you receive a call for a person who answers at an extension telephone, see that your receiver is replaced as soon as the telephone is answered.

Watch your telephone, see that employees are careful to replace the receiver, your service will be improved and you will aid us to increase the efficiency of the service throughout Jacksonville.

May we have your co-operation?

SOUTHERN BELL TELEPHONE
AND TELEGRAPH COMPANY



Safeguard Your Service

BUY A HOWLER

Spare your subscribers and yourself delays due to receivers being off the hook

The Kellogg howler (illustration above) is one of our standard induction coils with interrupter and condenser mounted on a nicely finish, oak panel.

It can be screwed up on the wall or set horizontally on a table or on the switchboard.

It is connected to the line through cord and plug at the board. Simply insert the plug in the jack "of the offending party" and work the key. A good lively "howl" is the result. If desired the apparatus can be connected to the wire chief's desk and he can do the signalling without carrying through the board.

Settle this "receiver off the hook" annoyance with dispatch. Buy a howler.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

MAIN OFFICE AND FACTORY: CHICAGO

CANADIAN SALES OFFICES:
DEERING ELECTRIC LIMITED, REGINA, SASK.
HOUSTON & COMPANY, LIMITED, WINNIPEG, MAN.
B. C. HOLST & COMPANY, VANCOUVER, B.C.

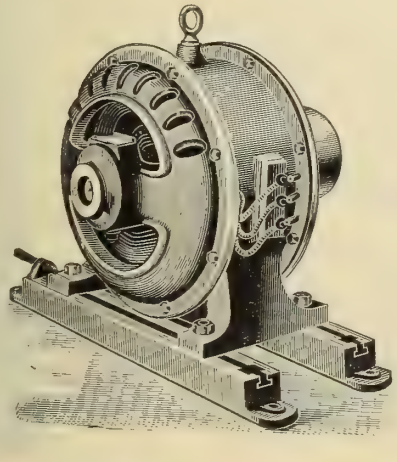


Cleveland Fare Box Co.

5310 St. Clair Ave., Cleveland, Ohio

Use Good Motors

to drive your factory



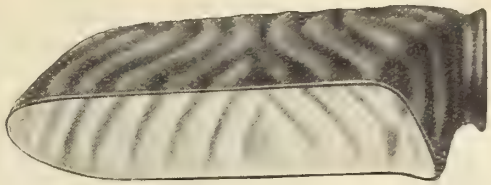
Such as are manufactured by

Toronto & Hamilton Electric Company

HAMILTON

Have you any repairs? Write us.

An X-Ray Reflector Worth Knowing



"MIDGET"

(No. 510)

A small reflector, 6½ ins. long and 1¾ ins. high, for use in lighting show cases, wall cases, pictures, small show windows and any interiors illuminated from cornices. It uses the new 25 watt tubular tungsten lamp.

X-Ray Reflectors are the only reflectors made exclusively for lighting different size store windows. They are the most powerful reflectors made; use the least current and cost the least to maintain. They are designed to illuminate the merchandise in a way to make it stand out like the stage display in a theatre. Their brilliancy is everlasting.

New Window Lighting Book

Describes the Full Line

In short, X-RAY reflectors have every point of superiority that 14 years study and experience in store window lighting have shown us must be present. That explains why we sell tens of thousands every year through the electrical trade. Are you getting any of these profits?

NATIONAL X-RAY REFLECTOR CO.

General Offices
Chicago
225 W. Jackson Blvd.

New York Office
The Eye Comfort Lighting Shop
14 W. 33rd St.

Ornamental - Luminous - Arc - Lamp -



The Lamp That Stimulates Business



Wherever this new Ornamental Street Lamp has been installed merchants are unanimous in their praise of it, because this handsome "white way" has considerably increased business.

Civic pride is aroused, citizens are taking more interest, are showing a greater enthusiasm and are more loyal towards their city than ever before.

This not only means increased trade to the merchants from residents but also from surrounding cities.

The New Ornamental Luminous Arc Lamp gives a brilliant, soft, white light, and by day the artistic poles add a charm and attractiveness to the thoroughfare.

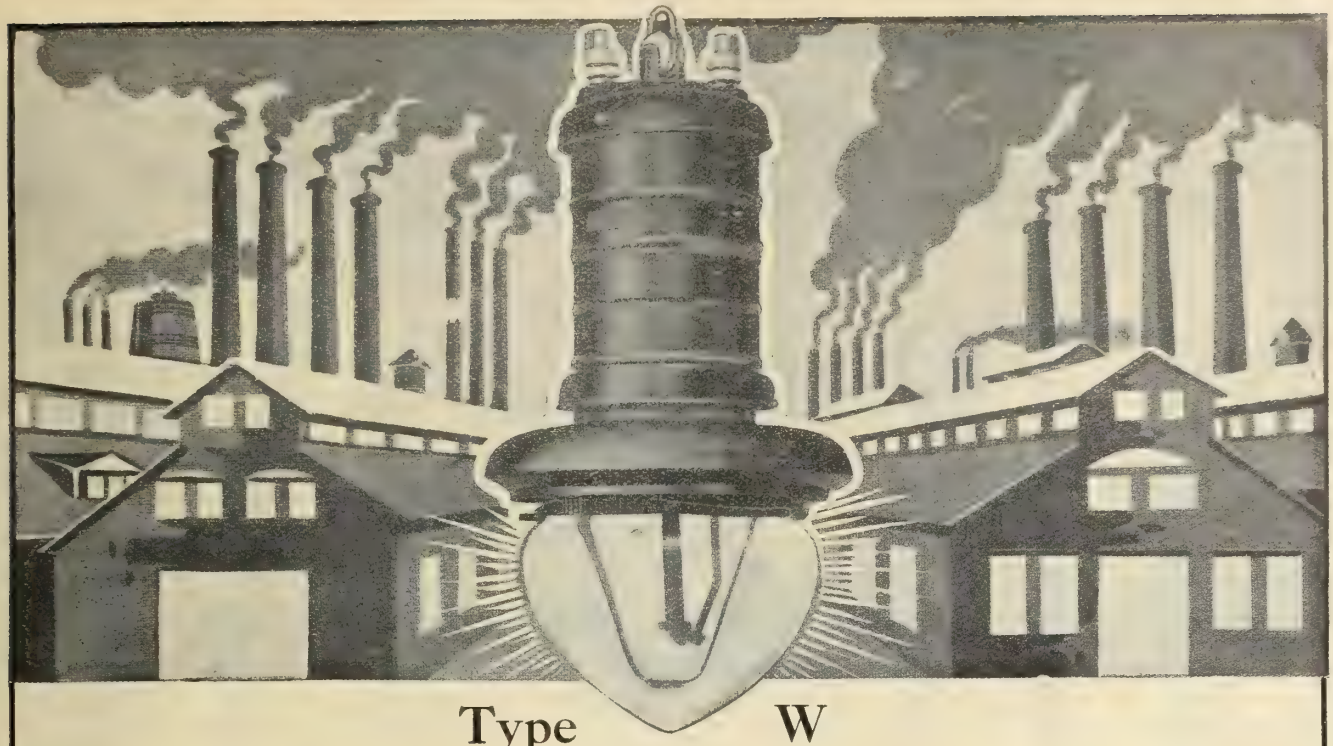
A bulletin "de luxe" showing many installations and describing this new system of Ornamental Street Lighting will be mailed on request.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
Cobalt Regina Edmonton Porcupine Saskatoon Nelson Prince Rupert



Type W

Long Life Flame Arc Lamp

In factories, yards, warehouses, foundries, machine shops, in fact everywhere where good, brilliant illumination is required over large areas this type of lamp is ideal.

C-G-E Flame Arc Lamps (Type W) are designed particularly for that purpose. **The brilliancy** of the widely-diffused illumination from this lamp remains constant throughout its long electrode life.

The arc is steady and is always in the same focus from start to end of trim.

Lower carbons have a life of from 100-125 hours, while the upper electrode is practically non-consuming.

Trimming is very simple and only one carbon is renewed. Either a white or yellow light can be obtained as desired, depending on carbon.

The mechanism is simple and readily accessible. One noteworthy feature is the efficient clutch which is sensitive and positive in its action.

The casing is weatherproof and insect-tight. This C-G-E Long Life Flame Arc Lamp is strongly and substantially built throughout. It is as reliable in operation as it is sturdy in construction.

Our branch office in your district will gladly furnish further information on request.

Canadian General Electric Company

Limited

Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
Cobalt Regina Edmonton Porcupine Saskatoon Nelson Prince Rupert

Duncan Quality

This is the goal of every process in the manufacture of our products—it's a habit. It applies to every line of our

Electrical Supplies





There's **your** guarantee, —the trademark which we back up all along the line.

It stands for the best of raw materials, the highest grade of workmanship and a rigid inspection before shipment.

Order through your jobber.

The
Duncan Electrical Co.
Limited

MONTREAL

The Triumph

of the Nulite Drawn Wire Continuous Filament Tungsten Lamp

CANADIAN HOME MARKET ASSOCIATION

TELEPHONE BUILDING

TORONTO

July 10th., 1913.

W. H. Ginder, Esq.,
Manager, The Canadian Tungsten Lamp Co. Ltd.,
Hamilton, Ont.

Dear Sir:-

On behalf of the committee in charge of the "Made-in-Canada" Train, which has just completed its tour through the West, I desire to thank you for your generous co-operation in supplying "Nulite" Tungsten Lamps for the entire train. You will no doubt be interested to know that they gave complete satisfaction, and we did not require to renew more than a dozen during the whole trip. This is a particularly good record when one takes into consideration the severe conditions under which the lamps were used. The train covered a route of nearly 7,000 miles, leaving Montreal on May 14th. and was on the road 52 days, making exhibits at 125 different towns and cities in the West. The train was subject to all the usual shunts, jolts, etc. incidental to steam railway operation, and notwithstanding this the lights, as you will note, required very few renewals, in fact after the first two days we got things so adjusted that there were practically no renewals from that time on.

Again thanking you for your kind co-operation in placing the lamps at our disposal, I am,

Yours faithfully,

H. D. Scully

Secretary.

HDS/M.

The lamps supplied for this train were the regular **60 watt 115 volt**. This train was equipped with a **steam generating plant of 115 volt** in order to allow exhibitors of electrical apparatus to demonstrate under actual working conditions their respective wares.

The above letter is unsolicited and speaks eloquently of the service, durability and efficiency of the NULITE Tungsten Lamp.

"NULITE" **A Canadian Product Manufactured by**

THE CANADIAN TUNGSTEN LAMP CO., LTD.

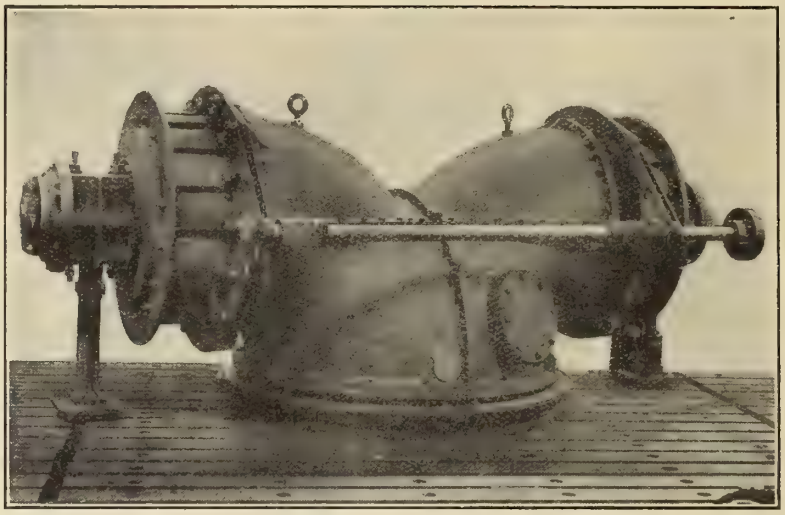
HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.
AGENCIES: T. McAvity & Son, St. John, N. B.; Farquhar Bros. Ltd., Halifax, N. S.;
Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto Ont.

Low Head Turbines

Built for

The Highest Efficiency



TWIN HORIZONTAL TURBINE

650 H.P. 360 R.P.M. 32 Ft. Head

We do not ransack the storehouse for something that will do—or nearly do.

We design and build our Turbines to meet the special conditions of each customer.

The customer, therefore, gets the highest efficiency from the water at his disposal.

WORKS:—MONTREAL and TORONTO

CANADIAN ALLIS-CHALMERS,

LIMITED

Head Office: King and Simcoe Sts., Toronto

Sales Offices: Halifax, Montreal, Ottawa, Toronto, Cobalt Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



—but the signs are as bright and legible as when new

The building was totally destroyed and the signs are as bright and clear as when new. Think of the planning, the construction that is necessary to make a sign that will show a record like that.

Federal Electric Signs

are built to ***last***—they are practically indestructible. And they are the most legible and attractive sign that can be made. The letters are clear and well formed, porcelain enamelled a brilliant white upon a royal blue background. The brightness of their coloring by day vies with the radiant gleam of their electric lamps by night.

An unlimited variety of sizes and models of Federal Signs enables you to obtain just the sign you want. Vertical or horizontal, with ornamental crowns or end pieces, single or double-faced, anything desired in signs can be supplied. They are made entirely of metal and will last a life-time.

Federal Sectional Signs are sold F. O. B. Hamilton, Ontario.

Central Stations will find interesting facts and figures in Bulletin No. 27111

Federal Sign System (Electric)

Lake and Desplaines Street, Chicago



The Lighting Unit of *Quality*

The Holophane Realite

For all sizes of Mazda Lamps.
25 to 500 Watts.

Write for prices and details also for Holophane Illumination Data.

Endorsed by all the most up-to-date Central Stations in Canada as promoting more satisfied customers by affording the maximum illumination for current consumed.

No other unit to equal it. **A Toronto product.**

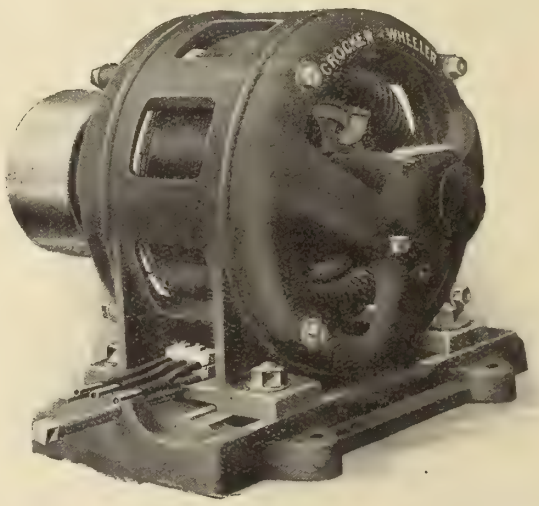
The Holophane Co., Limited, Toronto, Can.

The design of Crocker-Wheeler Induction Motors

includes

Large Shafts
Ideal End Ring Construction
High Power Factor
Large Journals

They have many other desirable features



Lumen Bearings
Strong Stator Frame
Heavy Insulation
Best Efficiency

Bulletin 155 describes them

THE CANADIAN CROCKER-WHEELER CO., LIMITED

MANUFACTURERS AND ELECTRICAL ENGINEERS

HEAD OFFICE AND WORKS:
ST. CATHARINES, ONT.

DISTRICT OFFICES:
MONTREAL, QUE. TORONTO, ONT. VANCOUVER, B. C.

Avoid Costly Interruptions of Service By Using Water-Proof Subway Boxes

When heavy rains or melting snows fill your subway manholes with water, you lose money through costly tie-ups, break-downs and interruptions of service, if your subway boxes are not watertight. You also lose the confidence of the public, which is one of your largest assets.

The only sure way to avoid trouble under these conditions, and keep your customers supplied with current, regardless of the arrival of the pumps, is to use the absolutely watertight

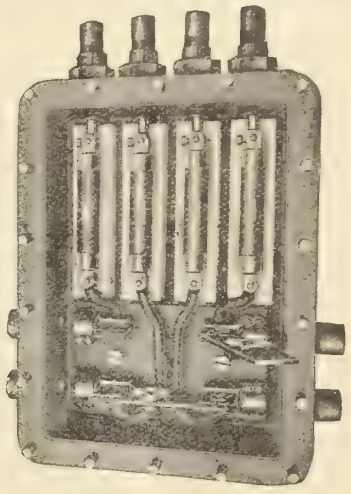
"NOARK" SUBWAY BOX

Both the box and cover have machined flanges, and a flat rubber gasket clamped between them prevents water from entering the box.

Inside the box, Bus Bars and Block Contacts, are mounted on substantial slate, porcelain or Ebony Asbestos Wood bases in such a manner that current can be distributed by means of single, duplex, or three wire cables, either lead or rubber covered.

"Noark" Subway Boxes are made in styles and sizes to meet all conditions of service. Every one is rigidly inspected and submitted to a test of 10,000 volts before shipment.

Write our nearest House for Catalog No. 406, which gives full particulars.



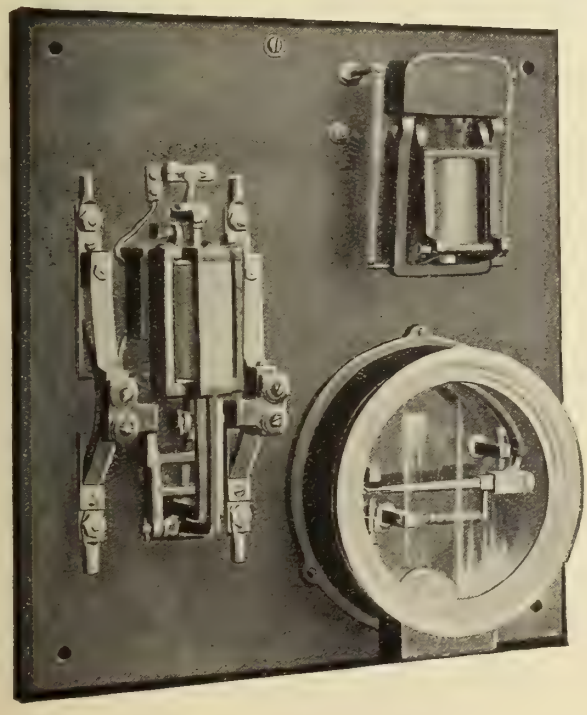
The Canadian H. W. Johns-Manville Co., Ltd.

Manufacturers of Asbestos and Magnesia Products — ASBESTOS — Asbestos Roofings, Packings, Electrical Supplies, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1741

Sundh Pressure Regulators



For use in starting A. C. and small D. C. Motors

Specially designed for installations where they can be thrown across the line without the use of starting resistance. Compact and reliable and will not get out of order.

When the amperes taken by motor exceed the 10 amp. capacity of the magnet switch, a switch of large capacity is added, the magnet switch acting as a relay.

We manufacture a complete line of controlling devices such as Motor Starters, Pressure Regulators, Tank and Sump Switches, Panels, etc.

Send for Catalogue

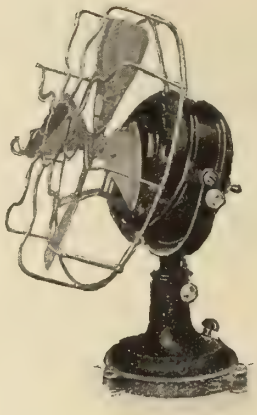
Sundh Electric Co.

NEW YORK, U.S.A.

Represented by the **C. H. L. Keeler Co., Ltd., Toronto, Canada**

ELECTRIC FANS

WERE you disappointed this season in not being able to procure a sufficient stock of fans to supply your customers? Or has your supply run out and are you unable to obtain repeat orders.



ELECTRIC FANS

WE are prepared to make prompt shipments on large or small orders. Anticipating a larger season this year than ever before, we have replenished our stock and are prepared to supply your demands promptly.

Our stock consists of fans of all sizes, both in stationary and oscillating types. Our fans are strong and reliable and guaranteed to give perfect satisfaction.

Write for special mid-season prices.

Stock carried at MONTREAL, TORONTO, WINNIPEG and VANCOUVER.

CANADIAN UNION ELECTRIC CO., LTD.

122 Wellington St., West
TORONTO

9 St. Nicholas Street
MONTREAL

THE MAINER ELECTRIC CO., LTD., 61-3 Albert Street, WINNIPEG, MAN.



Salability ✓ Quality ✓ Price ✓ OK

That's Delica White!

¶ It was neither chance nor advertising that drove Delica White Lighting Glassware to the very pinnacle of popular favor—**it was quality.** Whether for direct or semi-indirect installation—electric or gas—it's right.

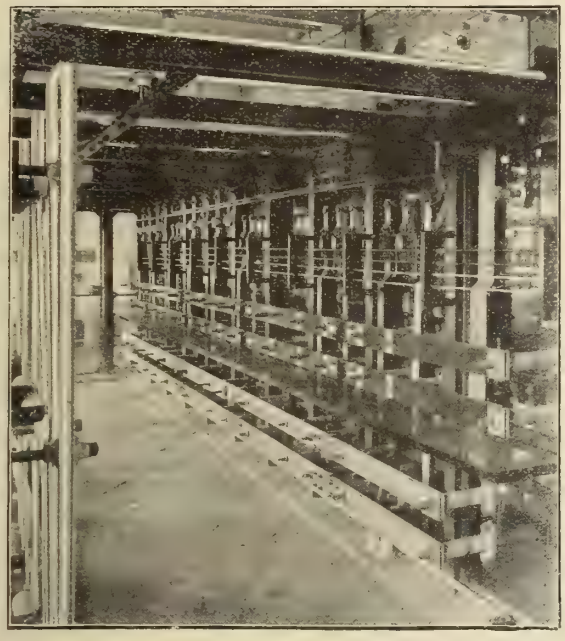
¶ It's what the people want. No matter who you are or where you are, how large or how small, your people need Delica White and will buy it when they see it. Write for our new catalogue—before you forget.

The Pittsburgh Lamp, Brass & Glass Co. of Canada, Limited

PILABRASCO

119 Wortley Road, LONDON, ONT.

R. E. Davis, Representative



WHY USE COPPER WHEN

ALUMINIUM

BARS AND RODS WILL GIVE YOU:—

GREATER EASE OF BENDING, WORKING AND WELDING.

50% WEIGHT REDUCTION.

SUBSTANTIAL ECONOMY.

GREATER OVERLOAD CAPACITY.

Think it over and then write to us.

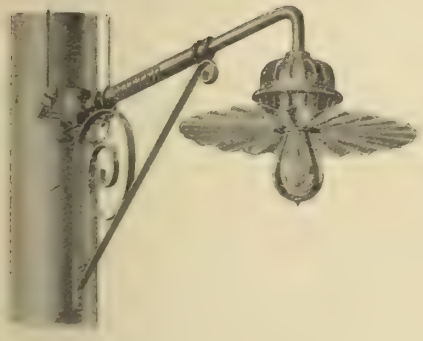
THE BRITISH ALUMINIUM COMPANY, LIMITED
(OF LONDON, ENGLAND)

60 WEST FRONT STREET, TORONTO, CANADA

Make Yours "THE CITY BEAUTIFUL"

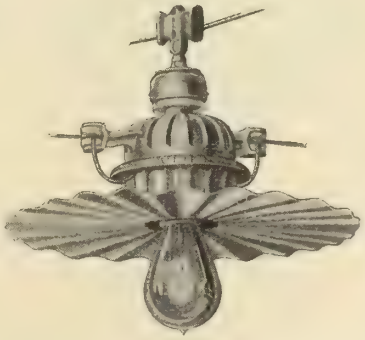
- - Install - -

CUTTER STREETHOODS



Cutter Boulevard Telescope Bracket with One-Piece Fluted Streethood.

Substantial Construction
High Insulation
Easy to Install
Artistic Appearance



Style G—High Voltage Cable Grip Suspension Streethood.

The body of our new type streethood is a reinforced porcelain insulator designed to receive series or multiple sockets. The fluted steel reflector is fire enameled—blue on top and white on the reflecting surface.

Write for Catalog No. 12

GEORGE CUTTER COMPANY, South Bend, Indiana, U.S.A.

423 Notre Dame Street



Reliable Manufacturers stand behind their products

The story of the Tungstolier is found in convenient bulletin form—get your copy.

Folding	Tungstoliers—Bulletin		No. 20a
Hammered	"	"	" 100a
Shower	"	"	" 100a
Semi-Indirect	"	"	" 100a
Mazda Box	"	"	" 100a
T. T. C	"	"	" 110a

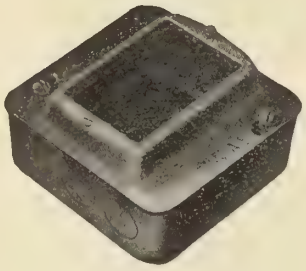
Also special designs on request.

The Tungstolier Company
of Canada, Limited
TORONTO

"GOOD STUFF"

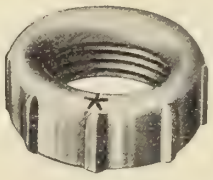
GET A SAMPLE

AND AT OUR EQUAL PRICES YOU WON'T WANT ANY OTHER MAKE.



"Steel City" Outlet Boxes

You cannot afford to use a box requiring more labor to install. Clean-Cut Knockouts. Sherardized or Enameled Finish. Packed in Heavy Paper Cartons and Wood Cases.



"Star" Bushings

The kind the wireman likes. The name is famous and the bushings have been favorites since they were first manufactured.

Also "Fullman" Floor Outlets, "Universal" Insulator Supports, Fixture Stems, "Superior" Fish Wire, Conduit Benders, Beam Straps.

Write for Catalogs

STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

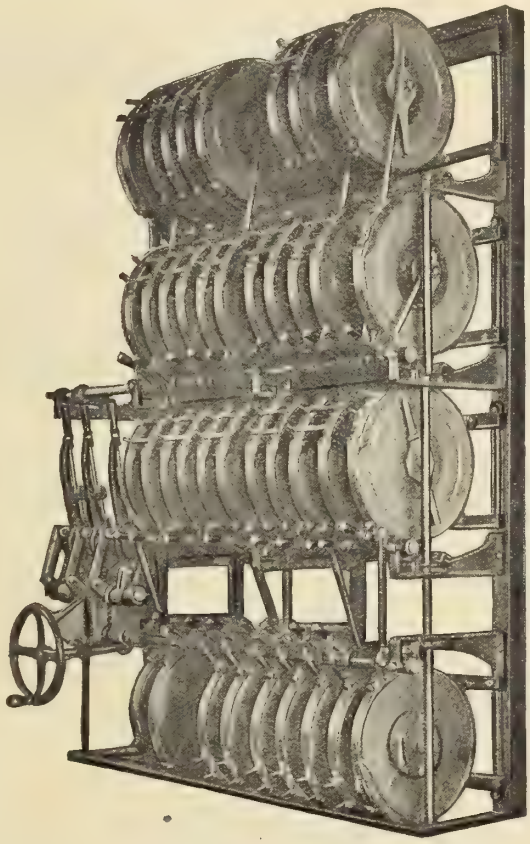
W. E. BUNDY, Canadian Sales Representative, 31 Melbourne Avenue, Toronto, Ontario, Canada.

CUTLER-HAMMER DIMMERS are used in the following New York Theaters

Academy of Music
Alhambra
American Music Hall
Astor
Berkley
Bijou
Bijou Dream
Broadway
Central Opera House
Central Theater Roof Garden
Geo. M. Cohan's Theater
Colonial
Columbia
Comedy
Criterion
Daly's
Delancey St. Theater
Eighty-Sixth St. Theater
Empire
Forty-Eighth Street Theater
Fox Tremont
Fulton
Gaiety
Garden
Garrick
Globe
Grand
Grand Opera House
Hudson
Irving Place
Keith's 14th Street
Keith's 23rd Street
Keith's 28th Street.
Keith's 58th Street
Keith's 125th Street
Knickerbocker
Lexington Avenue
Liberty
Lincoln Square
Little Theater
Loew's Circle
Loew's 30th Street
Loew's Seventh Avenue
Lyceum
Lyric
Madison Square
Manhattan
Manhattan Opera House
Maxine Elliott
Metropolis
Metropolitan Opera House
Miner's Bowery
Miner's Eighth Avenue
Murray Hill
New Amsterdam
New York
Olympic
Park Theater
Palace Theater
Republic
Savoy
Star
Third Avenue
Thirty-Ninth St. Theater
Tremont
Victoria
Wadsworth
Waldorf-Astoria
Weber's
West End
Winter Garden
Yorkville

90 Per Cent of New York Theaters Use Cutler-Hammer Theater Dimmers

The oldest and newest, the smallest and largest theaters use Cutler-Hammer Dimmers. A glance at the lists of theaters shows the practically unanimous selection of C-H Simplicity Dimmers in cities that are the leaders in the theatrical field.



Bank of Dimmers installed in Chicago Auditorium.
New type "Simplicity" Dimmer Plates used.

A NEW DIMMER PLATE
For Tungsten Lamps

has been developed which has many marked advantages, especially where tungsten lamps are used. The large number of steps provide extremely fine variations in lamp brilliancy. Windings are placed on both sides of the plate making each plate the equivalent of two.

The theaters are overhauling their electrical equipments now, so you better drop us a line for our Theater Dimmer Booklet which contains all the Bulletins on this subject.

The Cutler-Hammer Mfg. Co.

Largest Manufacturers of Electric Controllers in the World

Milwaukee, Wisconsin

NEW YORK: Hudson Terminal, 50 Church Street.
PITTSBURG: Farmers' Bank Building.
PHILADELPHIA: 201 Chestnut Street.
CHICAGO: People's Gas Building.
BOSTON: Columbia Life Building.
CLEVELAND: Schofield Building.
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St. SAN FRANCISCO: 229 Sherlock Bldg., PORTLAND and W. B. Palmer, 416 E. 3rd St., LOS ANGELES.

CUTLER-HAMMER DIMMERS are used in the following Chicago Theaters

Academy of Music
Alhambra
Auditorium
Blackstone
Casino
Chicago Opera House
College
Colonial
Criterion
Crown
Empire
Empress
Englewood Masonic Temple
Fine Arts
Garrick
German
Haymarket
Hull House
Illinois
Illinois Athletic Club
Imperial
Indiana
La Salle
Little Theater
Lyric
Majestic
Marlowe
Masonic Temple
McVicker's
Medinah Temple
New Medinah Temple
Olympic
Orchestra Hall
Palace
Plaza
Power's Opera House
Princess
Ravinia Park
Star and Garter
Studebaker Theater
Studebaker Music Hall
White City
Willard
Ziegfield

CUTLER-HAMMER DIMMERS ARE ALSO USED IN

18. Philadelphia Theaters
22 Brooklyn Theaters
20 Boston Theaters
8 Pittsburg Theaters
and in
Buffalo
Cleveland
Detroit
St. Louis
San Francisco
Washington
Seattle
Portland
Minneapolis
Milwaukee
St. Paul
Baltimore
Cincinnati
Newark
Jersey City
Rochester
Denver
New Orleans
St. Paul
etc., etc.

Packard

SUPERIOR QUALITY

Packard

Whenever you see this trade mark

THINK OF

LAMPS, METERS and TRANSFORMERS

It stands for the highest attainment both in design and mechanical construction. It is an absolute guarantee of quality. It is a positive insurance against breakdown and failures.

Large stock, from which we make prompt shipments, carried at St. Catharines and Winnipeg; St. John Railway Co., St. John, N.B; General Supplies, Limited, Calgary, Alta.

The Packard Electric Company, Limited

Factory: ST. CATHARINES

General Sales Office;
901-902 Traders Bank Building,
TORONTO

N. W. Office and Warehouse
WINNIPEG

Packard

HIGH-GRADE WORKMANSHIP

Packard





Where QUALITY counts in

WIRES

AND

CABLES

SPECIFY CANADA BRAND

BARE and INSULATED WIRES,
RAILWAY and POWER FEEDER CABLES
in Copper or Aluminum.
COPPER TROLLEY WIRE
COPPER CLAD WIRE
(Duplex Metals)
GALVANIZED STEEL STRAND
GUY WIRE

Stocks of wire and cables carried at Toronto, Montreal, Winnipeg and Vancouver.

Canada
Wire & Cable Co., Limited

1160-1170 Dundas Street

Toronto, - Canada

Sales Agents:

Roper, Clarke & Co., Limited
Montreal

A. E. Esling, Scott Block
Winnipeg

Macdonald, Marpole Co., Limited
Vancouver

Messrs. Gorman, Clancy & Grindley,
Calgary and Edmonton, Limited







Dietrich LIMITED

designs Underground Conduit Systems

right and instals them **properly** no matter what natural difficulties may present themselves.

¶ Repeat orders indicate the satisfaction of our clients.

¶ The cut shows the **fourth** contract we have received from this railroad.

300 Read Bldg., MONTREAL



BANNER TRADE MARK.

Artistic and Attractive Designs in

Lighting Fixtures

"Banner" Electric Fixtures embody all the popular and most up-to-date designs together with many of our exclusive creations.

Write us for an estimate on your next job.

We specialize on making fixtures from original drawings on short notice.

"Banner" Fixtures

MADE BY



Ontario Lantern & Lamp Co., Limited,

HAMILTON, CANADA.

G. M. Gest

Conduit
Engineer & Contractor

503 Power Building, Montreal, Can.



NEWTYPE
BERGMANN
LAMPS

(*Tungsten Filament*)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO., LIMITED

329 CRAIG STREET WEST
MONTREAL, P.Q.

LIVE AGENTS WANTED ALL OVER CANADA

Moonstone Glass



Grecian Lantern

Lanterns and Canteloupe Ball Globes are decorative and efficient Being made of **Moonstone Glass** the absorption of light is less than from any other semi-translucent glass on the market

The Grecian Lanterns and Cateloupe Ball Globes are made in five different sizes—illustrated in Moonstone Bulletin No. 1

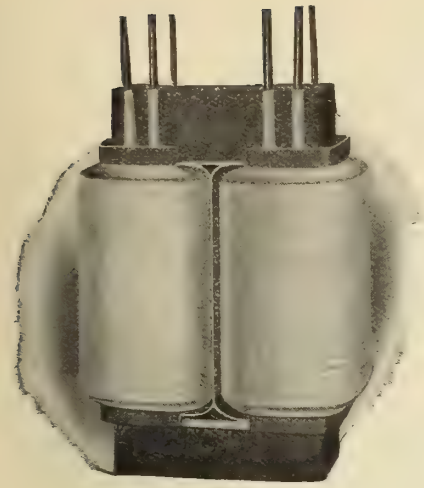


Canteloupe Ball

The Jefferson Glass Company Limited

MADE IN CANADA

TORONTO CANADA



Low Temperature Rise

THE extremely low temperature of rise of Moloney H. E. Transformers prevents the deterioration of the insulation, also the ageing of iron, and theretore removes the limitation of output.

Copper coils are outside of the core, causing the heat of the coils to be easily and rapidly dissipated outward in a constantly increasing circle to the exterior of the transformer case.

The maintenance of low temperature in Moloney transformers effects a great saving in their operation and maintenance.

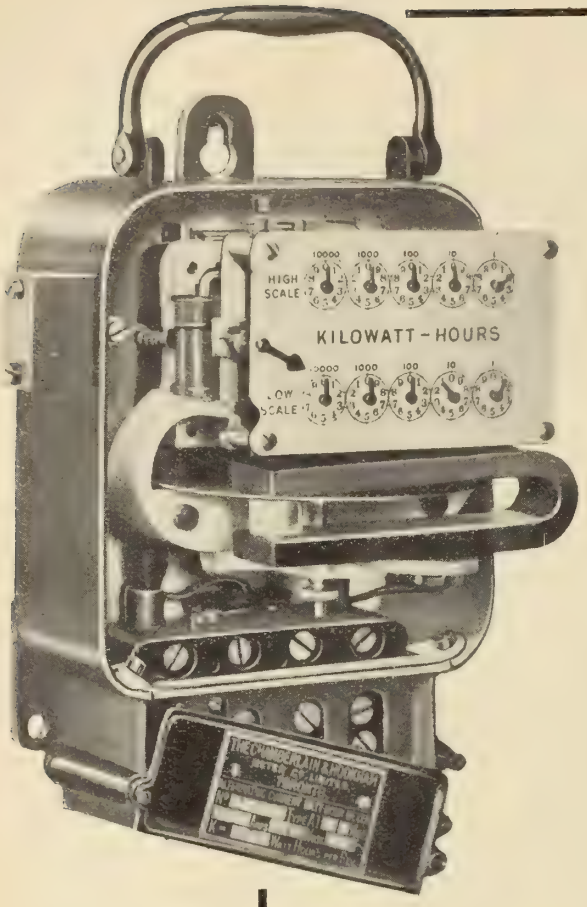


Write for the Moloney Catalogue.

Canadian Moloney Electric Company, Limited

WINDSOR, ONTARIO

Complete Stocks at **Windsor, Winnipeg, Vancouver**



A Meter and It's Merits

We could laud to the skies the merits of C. & H. Meters which to you, as an interested reader, would be of very little value. What you want to know is,—**will the meter record accurately and continuously?** In reply to this question we would say that C. & H. Meters are doing this for hundreds of constant users and performing service in a highly satisfactory way.

The illustration shows a

C. & H. Two-Rate Meter

Single, Two or Three Phase Circuits

which has demonstrated its efficiency times without number. We would be pleased to demonstrate this meter to you and endeavor to show how it will materially increase your profits.

A large stock of A. C. meters, Three-phase meters, Two-rate meters and Prepayment meters is carried at our new warerooms.

We will gladly furnish you with further information about C. & H. Meters.

Chamberlain & Hookham Meter Co., Ltd.
120 Richmond West Toronto
Eastern Representatives:
Spencer & Aspinall, 617 New Birks Bldg., Montreal, Que.

The CANADIAN BRITISH ENGINEERING COMPANY

LIMITED

WINNIPEG BRANCH - 324 Smith St., Winnipeg

Wholesale Electrical Supplies

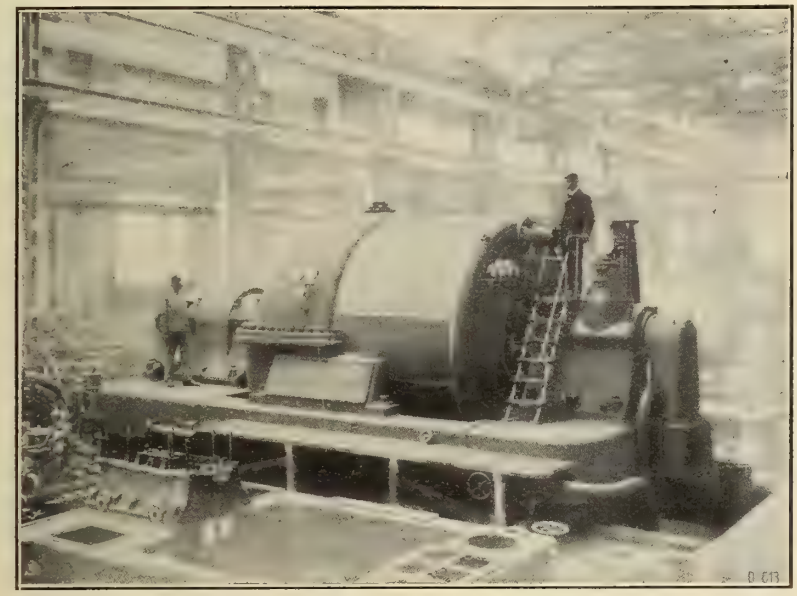
A large and varied stock carried at our Winnipeg warehouse including

- Wires and Cables
- Conduits
- Conduit Fittings and Boxes
- Switches
- Fuses
- Cutouts
- Sockets
- Receptacles, etc.
- Mazda and Carbon Lamps
- Street Light Fittings
- Telephones
- Bells and Fire Alarms
- Dry Cells
- Secondary Batteries
- Heating and Cooking Devices
- Electric Motors
- Electric Meters

OUR ENDEAVOR

is to ship standard supplies the day order is received

ESCHER WYSS



28,000 H. P. Zoelly Steam Turbine

Zoelly Steam Turbines

up to

15,000 K. W.

Water Turbines

Impulse Wheels

Turbo-Pumps

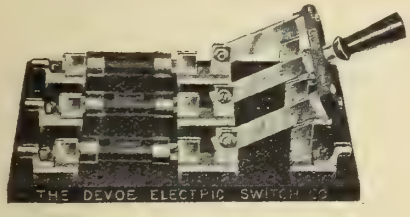
Refrigerating Plants

Escher Wyss & Co., 626 Coristine Bldg., Montreal

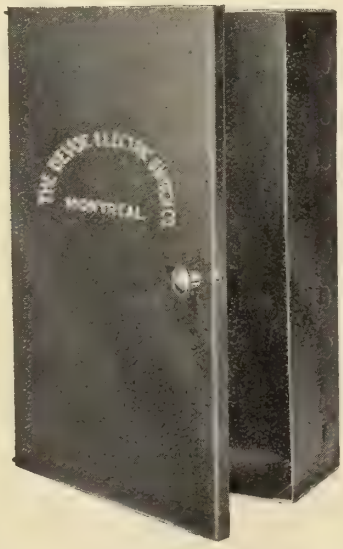
The Devoe Electric Switch Company

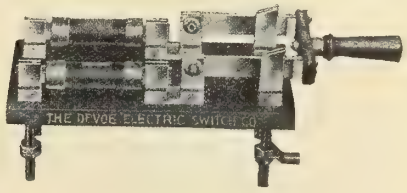
Manufacturers

We design and manufacture, Switchboards, Panel boards, Cabinets, Switches and Iron Boxes of every description.
Quotation promptly made upon request when drawing or sufficient data are submitted.

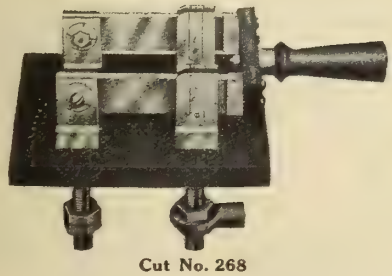


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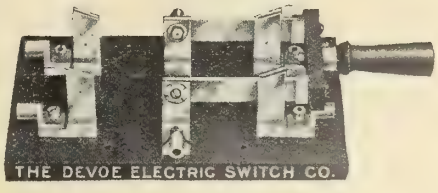




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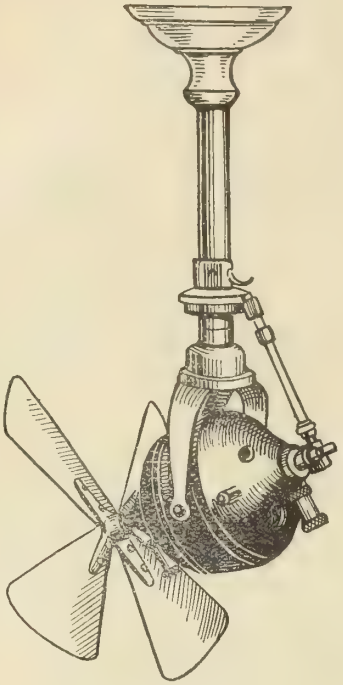
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Write for catalog No. 6. *Send us your specifications.*

OFFICE and FACTORY, 157 Craig St. West, MONTREAL



CEILING FAN
(Self Rotating)

The Fan Season is Now Here

FANS LEAD ALL OTHERS

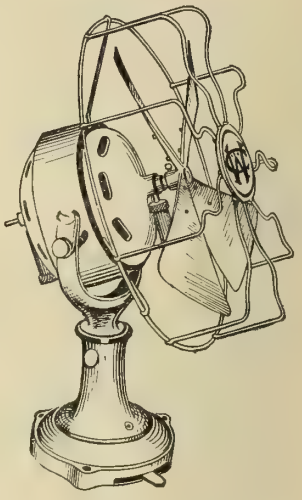
C & W fans are attractively designed and noiseless in operation.

C & W oscillating fans are the neatest and most perfect on the market.

C & W Self Rotating ceiling fans are much superior to anything heretofore offered.

You will be asked for C & W Fans.

Write us for catalogue and prices.



DESK FAN
(Oscillating)

CHAPMAN & WALKER, Limited

118-120 Richmond St. W., TORONTO, ONT.

VANCOUVER WINNIPEG MONTREAL



No. 21 Bulb, 50 C. P.

We are sole Canadian agents for

"ROYAL EDISWAN"

CARBON FILAMENT LAMPS

In the manufacture of the "Royal Ediswan" Carbon Lamp, the makers have spared no effort to perfect a product of superior quality and maximum efficiency.

Those among your customers who prefer the carbon filament lamp will find the "Royal Ediswan" a satisfaction which comes only from a high-grade product.

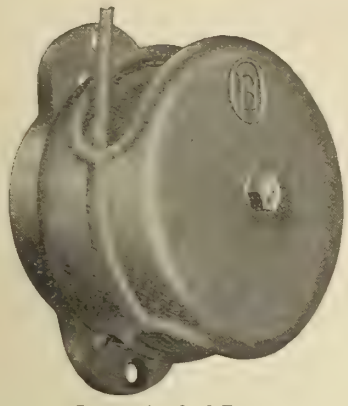
Made in standard American bulbs, (also fancy bulbs) and built to standard specifications.

We are prepared to make prompt shipments on all orders—large or small.

Chapman & Walker, Limited

TORONTO 118-20 Richmond St. W., ONTARIO

MONTREAL WINNIPEG VANCOUVER



Patent Applied For

A New Trolley Catcher

Extensive service tests have proven the merit of the O-B Trolley Catcher.

Catches the trolley and **holds it** when caught. Cannot "step up."

Correct in design and rugged in construction.

A Catcher will be sent at our expense for a service demonstration on your lines.

The Ohio Brass Co. Mansfield, Ohio, U.S.A.

HURLEY
ELECTRIC VACUUM CLEANERS

are the only cleaners that will positively and with the greatest ease pick up threads, ravellings, lint, hair, etc. This is an exclusive feature and not to be found on any other machine on the market. **Mechanically** they are perfect. Every part entering into their construction is of the very best material that can be obtained for the purpose intended. The fan is direct connected to the shaft of the motor insuring durability.

Send us an order for a trial machine, compare it with other makes, point for point and you will be convinced that it stands supreme in a class by itself.

Made in two sizes—"Hurley Six" and "Hurley Four"

Write for descriptive literature and prices.

Mainer Electric Co., Limited

Winnipeg, Man. **Edmonton, Alta.**

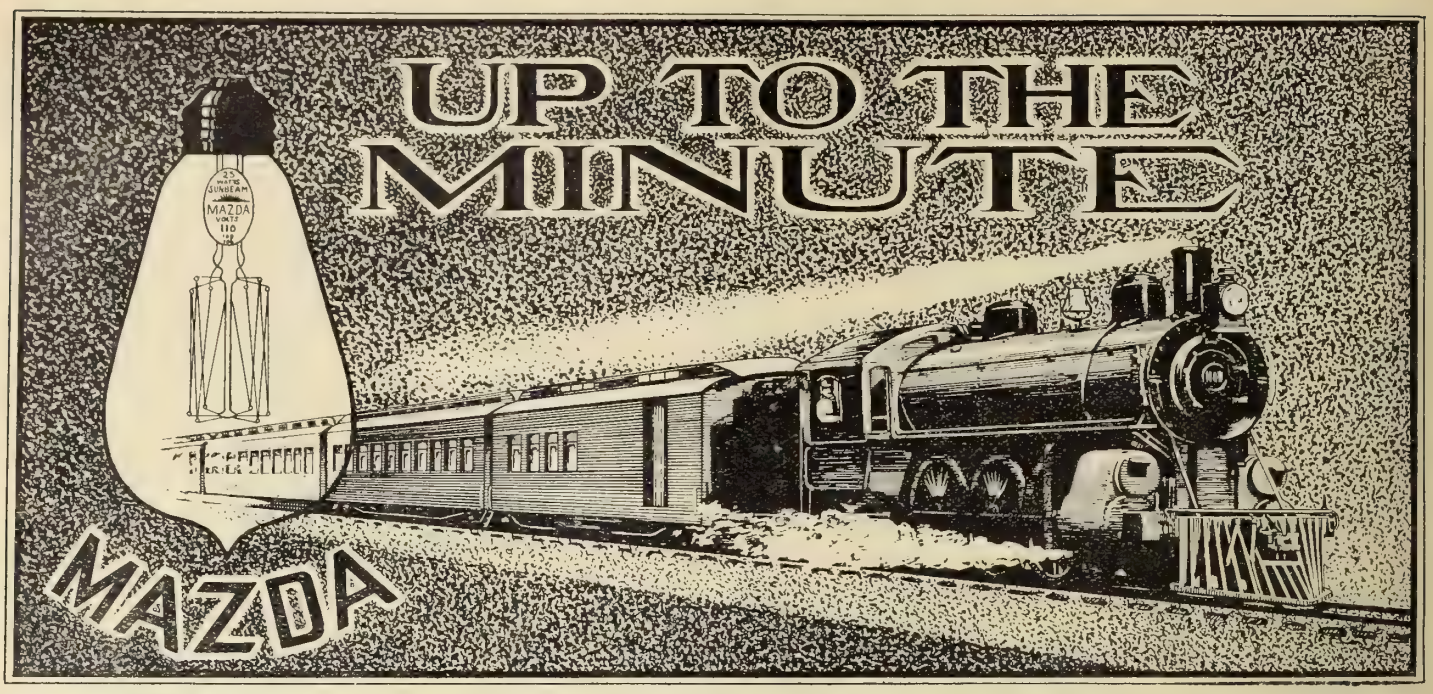
The largest Electrical Supply House in the West

The Lachute Shuttle Co., Limited

Lachute Mills—P.Q.

Manufacturers of

Cross Arms—Space Blocks—Birch and other Hardwood Insulator Pins and Brackets.



Sunbeam

Mazda Lamps

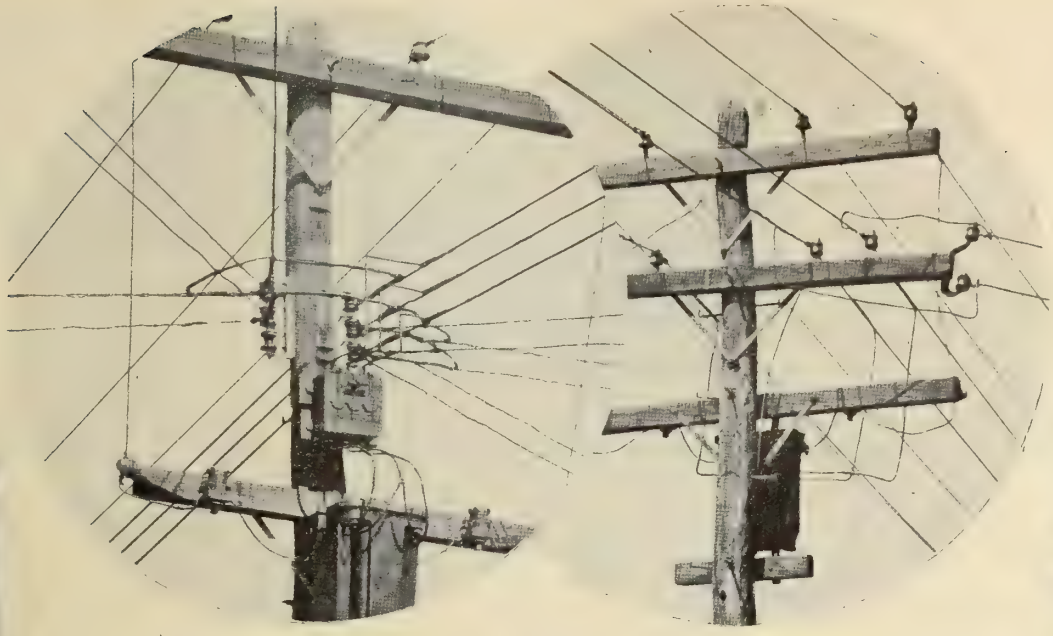
Are up to the minute in every respect.
They give a bright white light.
Are not fragile.
Burn at any angle.
Are long lived.
Give three times as much light as a carbon lamp.
Made in many sizes and shapes.
Get our prices and particulars.

Canadian Sunbeam Lamp Co., Limited

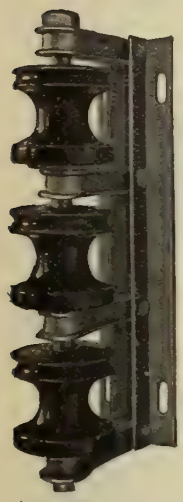
Main Office and Factory: TORONTO

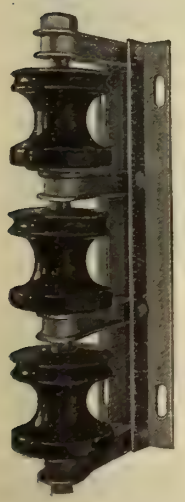
BRANCH WAREHOUSES:

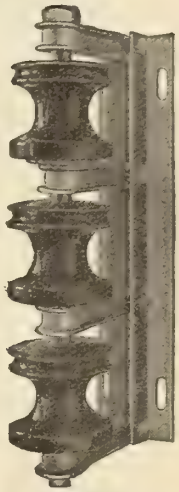
MONTREAL **WINNIPEG** **CALGARY** **VANCOUVER**















The Old Horizontal System of Distribution

is Due for a Total Eclipse

It involves expensive, unsatisfactory crossing of wires and heavy up-keep expense. It crowds the pole with only a few service connections, and it looks ragged. If you want to save first cost and maintenance cost, adopt

Vertical Distribution with Peirce Secondary Racks

You will reduce inductive drop, because the wires can be strung close together without danger of touching. You will get uniform sag—you will avoid crossing of wires. You will get greater strength at lower first cost and negligible maintenance cost.

If you figure in everything from first cost to interest and depreciation, you'll find the saving amounts to nearly 85 per cent.

Remember that Peirce Secondary Racks are backed by the Hubbard Guarantee, which knows no time limit.

Peirce specialties and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.

The Hardware MAKES the Line
Hubbard Makes THE Hardware

Hubbard and Company

Pittsburgh, U. S. A.



Keystone Strain Insulators Are Strong

They are hard and tough. Have great resistance to both compression and shear. Have great electrical resistance. They are given a heavy brown glaze and are designed with protected end coverings through which the guy wires pass, thus making it impossible for them to ever come in contact with each other.

Just compare the following strengths of Keystone Porcelain Strain Insulators with any other types you have in mind. Three samples of No. 1 were tested; two of No. 2; two of No. 3.

ELECTRICAL TESTING LABORATORIES

No.	Ins. Length	Average Load First Crack	Average Load Ultimate
1	3	16,600 lbs.	....
2	3½	21,350 lbs.	27,600 lbs.
3	5½	24,650 lbs.	29,575 lbs.

Isn't this the kind of porcelain strain you want to use on your work? Get samples or quotations either from John Millen & Son, or ourselves.

JOHN MILLEN & SON, LIMITED
Canadian Distributors
TORONTO MONTREAL WINNIPEG VANCOUVER

ELECTRIC SERVICE SUPPLIES CO.
Manufacturers
PHILADELPHIA 17th and Cambria Sts. NEW YORK Hudson Terminal CHICAGO 417 So. Dearborn St.



A GOOD OPPORTUNITY

To become familiar with our Station Switches and our Three Pole, Pole Top Outdoor Disconnecting Switches, opening all Poles at once from the ground, is **overlooked if you** don't **procure** a copy of our Blue Catalog and Switch Bulletin. A five-year positive guarantee assures you of our responsibility. Cable End Bells, Bus Bar Supports, Switchboard and Pipe Frame Fittings, Clamp Insulators, Station Pins and other Station and Transmission Specialties.

ELECTRICAL ENGINEERS EQUIPMENT CO.
10-12 N. Desplaines St., CHICAGO, ILL.
NORTHERN ELECTRIC & MANUFACTURING CO., LTD., Canadian Agents

Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY

HUGH C. MacLEAN, LIMITED,

HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.

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The "ELECTRICAL NEWS" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum, United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, August 1, 1913 No. 15

Theft of Electric Current

There is an odd inconsistency streak in the make-up of many an otherwise honest man which will allow him, with a perfectly clear conscience, to cheat a large private corporation by misrepresentation or by theft, direct or indirect, or by any one of the many "inactive" methods that, in the nature of the public service business, always lie open to the individual who cares to take advantage of them. Perhaps the most common and the easiest of these is the non-payment of fares on a steam or electric railway, but petty theft of gas and electric energy is also common in many cities and towns. And this petty sneak thieving is often traceable to individuals who consider themselves thoroughly straightforward and honorable and are generally so considered by others. It is an inconsistency that is very difficult to understand and yet none the less an offense against all legal and moral laws quite as much as the theft of any other kind of personal property. The very fact of getting on a train or electric car is a recognition of an agreement entered into with the company, by which the individual carried obligates himself to pay to that company a stated tariff for services rendered. So with gas or electric light or power.

Petty thieving of electric energy has been going on in Montreal, among other places, for some time, and although the companies have been aware of the fact they have hesitated to take action, for various reasons. Probably the chief reason is reluctance on the part of the companies to expose the wrong doings of any so-called respectable citizen. Also, under the circumstances, it is often difficult to prove theft. There is the further reason, too, that, strangely enough, the companies get little sympathy from the general public in such matters and are apt to lose customers or make enemies and so injure their business to a much greater extent than the petty dishonesty of a few can do. This phase of the question has deterred more than one company of which the writer has knowledge from taking any steps to prosecute offenders in the public courts. Every lane has its turning, however, and recently the Montreal Light, Heat & Power Company have decided to make an extensive inspection of their customers' premises and prosecute wherever guilt is found. Already a stiff sentence of three months' imprisonment, without the option of a fine, has been meted out to one of the offenders and it is said a number of other cases are soon to be dealt with. It is to be hoped other companies will be equally courageous and make this a time of general housecleaning. Quite aside from the financial loss, the removal of the evil influence of unpunished dishonesty on the moral tone of a neighborhood is quite worth the trouble required in locating and convicting the unscrupulous offenders.

Coast Developments

Judging from present indications the next two or three years should witness the development of an immense store of electrical energy in British Columbia. Scarcely a month passes without some announcement of importance relating to projected hydro-electric undertakings on a large scale in various parts of the province, and it would seem that if only a few of the power schemes already proposed reach the ultimate development planned, a period of unprecedented industrial activity in this part of the country will be the natural outcome. The latest electrical project is that announced by the Bridge River Company a recently incorporated concern backed by prominent Vancouver capitalists, which, in anticipation of the future power requirements of greater Vancouver and the probability of the electrification of the coast section of the Pacific Great Eastern Railway, plans to develop upwards of 200,000 horse power in the Lillooet district. It is proposed to build a large dam on Bridge River and to drive a tunnel one and three-quarters miles long through a mountain to an inlet on Seaton Lake. It has already been established that Bridge River, at the point where the dam will probably be built, is 1100 feet higher than the level of Seaton Lake. No engineering difficulties, it is expected, will be encountered in driving a tunnel for the intervening distance. The scheme was recently favorably reported on by Mr. W. C. Smith, engineer of the water rights branch of the provincial department of lands. Mr. Smith made a detailed examination of the Bridge River, which is a large mountain stream with an enormous drainage basin, ensuring a large water supply the year round. He was accompanied by Mr. W. R. Bonnycastle, of Vancouver, engineer of the power company, who is now engaged in completing all the surveys. Application for water records aggregating 100,000 acre feet have been made to the provincial Government. The project has also been favorably reported upon by other engineers. It is expected that the whole will involve the ultimate expenditure of approximately $8,000,000.

Power transmission at long distance has been successfully solved and it is thought there will be little waste between the proposed power plant on Seaton Lake and Vancouver. The proposed power line will follow the route of the Pacific Great Eastern Railway Company and will be about 150 miles long. As the proposed power house will be less than forty miles from the main line of the C. P. R. and Canadian Northern Railways at Lytton, the promoters hope also to sell motive power to both lines. While nothing really definite can be learned at present with regard to the probable date of the commencement of operations, it is understood that active construction work will be started before the end of this year, or early in 1914. Two or three years are bound to

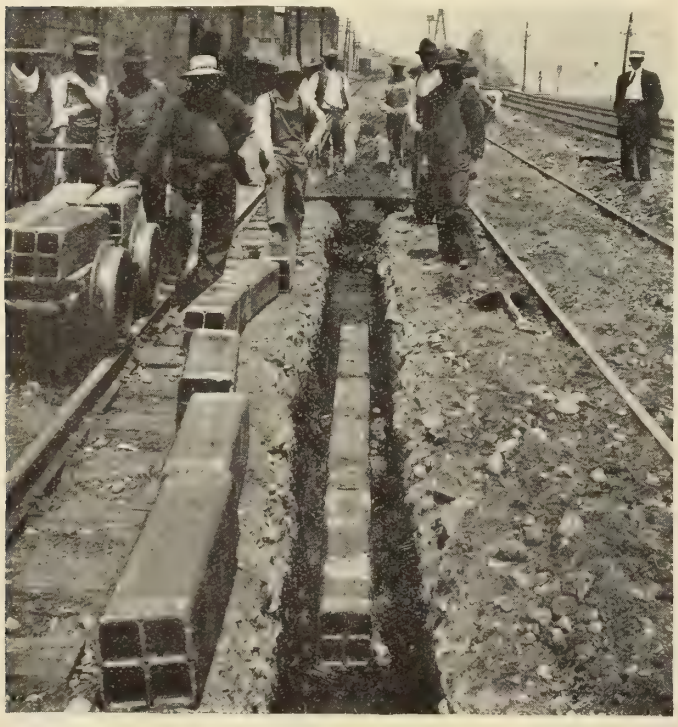
elapse however before the company will be in a position to supply power.

The Canadian General Electric Company, as already announced, has been awarded the contract for supplying the necessary machinery for the electrification of the C. P. R. line between Castlegar and Rossland in British Columbia. The intention is to use 2400 volts, direct current trolley system for electric locomotives, the power to be obtained from the plant of the West Kootenay Power & Light Company, Limited, at Bonnington Falls, near Nelson. The section of the line which is to be electrified is thirty miles in length and has very heavy grades and numerous loops. The funds for the improvement scheme were appropriated at the beginning of the year and it is proposed to have the work well under way this season.

C. P. R. Conduit Construction

With a view of eliminating the overhead transmission lines of the C. P. R. telegraph company and simplifying the signal system in the yards from Delorimier Avenue and Notre Dame Street to Ontario Street, Montreal, the C. P. R. decided to lay conduits between those points. It is obviously difficult to handle signal work in a large railway yard from overhead construction; conduits do away with delays from ice and snow inevitable in pole work, and although the capital cost is larger, the maintenance charges are by no means as heavy. The contract was carried out by Dietrich, Limited, Montreal.

The whole installation is located between two main lines entering Place Viger station, and involved work under two



Laying Conduit in Hochelaga Yard, C.P.R., Montreal.

bridges and over one subway. This point is a particularly busy one, and with the railway service being carried on during the entire period, the work was one of more than ordinary difficulty. The conduit is approximately one mile in length, and consists of 4-way vitrified clay duct laid in a complete envelope of concrete 3 in. thick. There are 16 concrete manholes 4 ft. x 5 ft. x 6 ft. inside measurement. The manhole space varies from 75 ft. to 575 ft., due to leads being taken off most of the manholes in order to operate the automatic signal system in the yards.

Almost from the start springs and quicksands were encountered, this necessitating the carrying of a 6 in. glazed tile drain for a distance of 2,600 feet. The drain was carried at a uniform depth of 6 feet from the surface, the entire yard being a grade of about one per cent. Fifteen pair 14 gauge, lead-covered, paper-insulated cable is used throughout.

Dietrich, Limited, have also completed the laying of two conduits in Toronto for the C. P. R. telegraph department. One on Dundas street west, Toronto, was notable for the large number of springs and quicksands, which involved the use of sheet piling throughout the job. In the other conduit, on Yonge street, the difficulty was due to the many wires and pipes. Besides gas and water mains, there were the lines of the Toronto Hydro, Toronto Electric Light Company, and the Bell Telephone Company, and a place had to be found for the C. P. R. conduit between these various wires and mains. The difficulties, however, were overcome, and the job successfully completed.

Further Plans Approved

The Quebec Public Utilities Commission, sitting in Montreal, have approved further plans of the Electrical Service Commission for placing wires underground. The conduits approved will be a continuation of those now being laid on St. Catherine street by Mr. G. M. Gest, the new section being from Guy to Atwater avenue; while the other conduits passed will run under Bleury street and Park avenue (from Craig street to Pine avenue).

Dr. Herdt, the chairman of the commission, explained the plans, stating that they might have to be varied a little as a great many obstructions were encountered that were not found in the city's records and street plans. At the corner of McGill College avenue and St. Catherine street (Mr. Gest's contract) they had an unusual amount of trouble on account of sewers and other pipes and conduits.

The new plans having been approved, tenders will be called for the construction of the conduits. The plans for the additional section of St. Catherine street are similar to those now being carried out, but a different system has been adopted for Bleury street. In conjunction with the civic conduits, one will be constructed for the Bell Telephone Company, the ducts being separated by 6 in. of concrete. The work will be carried out under the supervision of the Commission, the Bell Telephone paying the cost. In the civic conduits there will be a main run of 28 ducts with other laterals on the west side of the street, with a feed across at certain intersections to manholes on the east side, thence north and south for certain distances under the sidewalk for serving each building.

In connection with the Bleury street plan, a new lighting scheme will be installed, consisting of 41 standards. Police patrol and fire alarm standards will also be erected.

Westmount Conduit Work

The Westmount, P.Q., Council have awarded a contract to R. T. Smith & Company, Montreal, for the construction of a conduit on Western avenue. The conduit, designed by Mr. G. W. Thompson, the general manager of civic affairs, will be constructed of vitrified clay ducts, of 3½ in. square bore, and will cost about $25,000. It is probable that, in the future, the conduit will be linked up with the system which is now being carried out by the city of Montreal, under the direction of the Electrical Service Commission. Wires for the police call, lighting, fire alarms and any other lines through the city that may be required will be placed in the conduit. Manholes will be built in every section of the con-

duit. The ducts will be purchased by the council, and R. T. Smith & Company will carry out the work of laying. It is intended that the Western avenue conduit shall form part of a general system for the city, which will involve the removal of the poles. The amount to be expended at the present time will be charged to the surplus arising from the electric lighting department, and for this purpose the amount set aside against depreciation of the electric plant will be reduced from eight to four per cent. annually.

In connection with the scheme, the city are installing on the same avenue 50 standard inverted magnetite arc lamps, manufactured by the Canadian General Electric Company. These are 14 feet high, and will replace the present bracket arc lamps.

A Prussian Government Water-Power Project

The Prussian Parliament has recently enacted a law appropriating $2,500,000, for developing water power on the upper reaches of the River Weser in Hanover Province and Waldeck Principality. It is proposed to utilize the water heads afforded by the already existing reservoirs at Hemfurt on the River Eder and Helminghausen on the Diemel, both source streams of the Weser, and later to connect these power plants with a third to be built at Munden, where the conflux of the Rivers Fulda and Werra gives rise to the Weser proper. In keeping with the more recent Prussian policy of direct development of water powers by the State, the waterways department of the Prussian Ministry of Public Works will undertake not only the construction but also the subsequent sale, up to a certain point, of the power to be developed.

Proposed Equipment of Plants

The reservoirs at Hemfurt and Helminghausen were built by the Prussian Government in connection with the construction of the Rhine-Hanover Canal under the law of April 1, 1905. When full the reservoir at Hemfurt imprisons 1,975 million gallons of water and the water head at the dam is then 135 feet. The reservoir at Helminghausen holds 194 million gallons of water when full. The maximum head is 114 feet. The hydro-electric station to be erected at Hemfurt, according to the present plan, will be equipped with six turbines, developing each 2,500 horse-power at a 105-foot head, six 2,300 kilowatt generators and three 5,000 kilowatt, 6,000-40,000 volt transformers. The cost, including machinery, buildings, and all accessories is estimated at $452,500. The station at Helminghausen will be equipped with two turbines, each developing 600 horse-power and one developing 1,200 horse-power at a 90-foot head, two 600 kilowatt generators and one 2,000 kilowatt, 6,000-40,000 volt transformer. The cost of this station is estimated at $95,200.

The third station—to be built later on the Weser at Munden—will cost with its various accessories $892,500. The machinery installation will include six turbines, three developing 1,240 horse-power each at a water head of 12.7 feet and three developing 460 horse-power at a head of 6.9 feet; three 1,200 kilowatt generators; and two 4,000 kilowatt, 6,000-40,000 volt transformers. In addition, a canal will be made at an estimated cost of $183,736, exclusive of land value, and a 656-foot lock constructed at a cost of $133,280.

The project contemplates the eventual linking of these three stations by a high-tension transmission line to cost $226,100. The total power which the combined plant will then be capable of delivering is 41 million kilowatt hours a year. As the maximum water flow available during the various seasons does not coincide, however, with the fluctuations in the demand for power, it is calculated that a yearly consumption of 29 million kilowatt hours can be taken care of without resort to a steam reserve. The prospective initial demand does not warrant so large a plant, and it is proposed accordingly to build only the Hemfurt and Helminghausen stations at present and to connect these with the steam-driven, electric-generating plant of the Prussian railway administration at Cassel, and possibly also with the municipal steam plants at Cassel and Gottingen, from which supplementary power can be drawn as the need arises.

How Current Will Be Sold

It is considered that the interests of the local inhabitants will be better served if the State itself delivers the power to the surrounding county governments for further distribution than if it is sold at once and entire to some private distributing concern. Direct sales will be made to the Prussian railway establishment at Cassel (station, yards, shops, etc.), and also, it is expected, to the cities of Cassel and Gottingen. Under the proposed arrangement the existing steam plants at these points will be allowed to remain idle except when, owing to low water or heavy demand, they are called upon to assist the water-power stations. Electricity will be sold to the two cities and the railway administration at 0.714 cent per kilowatt hour and purchased from them when needed at 1.428 cents. According to estimate it will be necessary at the outset to buy only 2 to 3 per cent. of the total current consumed in any year not attended by unusual water conditions. It is possible that in the future direct sales will be made to other large establishments, such as manufacturing plants, etc., but for the present, except in the three instances noted, the power will not be sold to ultimate consumers, but to the county governments or to companies formed in one or more counties under special provisions of law.

The region to be served includes 13 counties in Prussia and 3 in Waldeck, representing a total area of about 2,500 square miles and embracing a population of about 600,000. It is estimated that approximately three-fourths of the prospective demand will be municipal and industrial and one-fourth agricultural. The current will be distributed to 15 points within this region by means of a 40,000 volt transmission system, which will be about 215 miles in total length and will cost to construct about $405,000. At each of the 15 points mentioned there will be a transformer station, where the current will be stepped down from 40,000 to 6,000 volts and delivered to the county governments or companies.

Cost to State of Electricity Developed

Calculated on the basis of five stages in the growth of demand, the cost of the electricity to the State at the transformer station switchboards will be as follows:

Stage	Yearly Consumption Kilowatt hours	Per kilowatt hour Cents
First	10,000,000	1.2
Second	20,000,000	.862
Third	24,000,000	.888
Fourth	30,000,000	.807
Fifth	40,000,000	.745

The Munden station will be built when the consumption approaches 24,000,000 kilowatt hours, so that the higher per unit cost at that stage, attributable to the necessity of purchasing large quantities of steam-generated electricity, will never be actually encountered.

On the basis of these cost calculations it is proposed to sell electricity to the counties at 1.428, 1.19, and 0.952 cents (6, 5, and 4 pfennigs) per kilowatt hour, according to the amount consumed. Forty-year contracts are being made, by the terms of which the counties or special companies formed therein undertake to purchase minimum amounts of power at the prices named and to distribute it to the ultimate consumers at 220 or 120 volts, as conditions require. They will be able to do this profitably, according to estimates, at 10.7 cents per kilowatt hour for light and 4.76 cents for power to small consumers and at considerably reduced rates to large consumers. The cost to the counties or companies of the equipment and

(Concluded on page 44)

Discussion on New Hydro-Electric Rules

At the recent Convention of the Canadian Electrical Association an interesting criticism of Mr. Strickland's paper on the new Hydro rules was read by Mr. S. Bingham Hood. Mr. Hood's criticism and Mr. Strickland's reply are printed below. The discussion is of unusual interest as throwing more light on a subject of vital importance.

Mr. Hood's Criticism

Some months ago a Committee, representing the Toronto Section of the A. I. E. E., was called together to discuss the proposed rules of the Hydro-electric Commission. This Committee was composed of men whose technical training made them thoroughly familiar with wiring and apparatus as covered by the proposed rules. The objections then raised to the rules, as then proposed, were so extensive that the Commission agreed to revise them and again submit them to the Committee for reconsideration.

The revision has apparently been made in some cases, but as far as I, a member of the Committee, know, they have never been re-submitted, and apparently the Institute has been ignored in the adoption of the final draft. This would appear to be a breach of good faith, and one which certainly should have the consideration of this Association, being so closely allied in its interests to that of the Institute. If our representative electrical bodies are to be ignored in the matter of formulation and adoption of rules in which they are so vitally interested, they can hardly be expected to show any very enthusiastic co-operative spirit.

The principal objection which is, and must always be, raised against these rules, irrespective of their fairness, or apparent fairness, is that their interpretation is in the hands of the most interested party. In the case of a city or district served by competing municipal and private companies, the chances for unfair discrimination are so self-evident that the fairest interpretation in the world must always be open to question. The fact that an appeal can be made to the Commission as a final resort is somewhat ludicrous, in that the court of appeal will, in most cases, be a joint partner with the municipality operating the inspection bureau. This point is brought to the attention of your Association merely to show in advance one of the difficulties our esteemed friends are going to run up against.

Generally speaking the rules, as now issued, are a credit to the men who have gotten them out, and closely follow those of the National Code, including the profuse explanatory notes which were so prominent in the old Code of some years back. These notes will no doubt be of immense value to the novice who is engaged in interior wiring so generally, and will also serve as a reminder to many of us who have been at the mill so long that we may have forgotten some of the points so carefully brought out.

There are two excellent rules embodied in this book—first: neutrals must be grounded; and, second: fuses must be omitted from these neutrals. This shows that the Commission have recognized the dangers of the omission of the first item and insertion of the second.

Unfortunately, however, they have stopped just too soon to make a good job of it. Having provided for keeping the neutral closed, and realizing the danger of its being opened, they tell us in the third paragraph on page 2 that we must insert the generator protection in the grounded leg, and again on page 26, rule (j), they specify a switch in every leg of the circuit. If it is dangerous to open a neutral with a fuse, why is it not equally dangerous to do the identically same thing at the switch? Again in rule (g), page 24, the same neutral that is required to be made solid in the three-wire line must be fused, simply because one of the outers is dropped off the circuit and the balance of the same circuit carried on to the utilization point. Why, in commonsense, can we not be allowed to kill two birds with one stone and make our system both cheap and of the utmost safety by using a solid common neutral supplying every utilization outlet? If we were allowed to do this, it would be but one step further to reach the ultimate point of cheapness and safety by making this neutral of bare conductor, heat insulated only from its supports. It is a regrettable feature of both these rules and our old friend, the National Code, that their makers (like all large bodies), move slowly. It has taken over ten years to get our neutrals grounded and get rid of the neutral fuse, and will probably take ten more before we will be allowed to use a common-grounded neutral to the same extent that has permitted the electric railway interests to operate their ground return system with the utmost simplicity, safety and reliability from its inception.

On page 113, rule 2, section (b), is interesting in that a two-wire circuit must be grounded up to 150 volts, but a three-wire system must be grounded with the sky the limit. This is no oversight, as shown by rule (h) on page 115, where over 150 volts may be grounded by special permission, with particular attention called to the fact that this does not apply to former rule (b). This point is mentioned as a discrepancy, and not as a criticism, as I firmly believe in grounding the neutral of every circuit irrespective of its voltage.

On page 52, section (h), the requirement of 2500 volt insulation on all service conduit leads over 150 volts is going to prove very detrimental to the use of 3-wire, 115/230 volt services. Similar discrimination is shown in the matter of meter and service equipments on page 57, rule (n), where metal enclosed switches and cutouts are necessary on a 3-wire service. This requirement should certainly not have been applied up to 300 volts, which would have covered all ordinary lighting services and given a factor of safety of 400 per cent. on standard 600 volt wire. The service illustrations of figures 18 and 21 have apparently been designed with the understanding that electricity is now so cheap in Ontario that no one but a fool would take the trouble to steal it. Rule (a), page 46, evidently has this in mind also, where it requires the switch to cut off current from everything, including meters. The central station must have control of the supply up to the meter and must maintain current on the meter at all times. Ample protection for the meter is provided by the sealed service fuse, and no exposed live contacts can be permitted on wires or apparatus carrying unmetered energy. Hundreds of thousands of dollars have been expended in the past few years in the development and installation of sealed service equipments, all designed with the switch after the meter. The largest company in the States turning out this line of fittings (and now operating a factory in Canada), has for its engineer the manager of the largest central station company in the world, whose experience along this line is beyond dispute. It will be interesting to watch the effect of the enforcement of this rule, which means the confiscation of practically every dollar's worth of apparatus now developed and used in direct contradiction to the rule. The National Code ruling of similar wording is now practically obsolete, owing to the opposition from the Class A members of the N.E.L.A., and I imagine the Ontario Commission's engineers may look for squalls ahead.

Another point, which has been recalled to my attention by listening to the paper on electric heating devices, is the adoption of the old Code rule of 660 watts and a six ampere fuse for branch circuits.

The rigid enforcement of this rule would have a serious effect on the use of appliances designed for attachment to ordinary lamp socket outlets. In practice the usual result of trying to enforce this impractical rule is the ultimate substitution of copper cents, or other make-shifts, for the original fuse which would not carry the load.

It is past me to understand why, when we are limited to

a minimum size of wire which is rated and approved for 15 amperes, we are not permitted to fuse this wire to over 6 amperes, or less than one-half its safe carrying capacity.

As promised at the Convention, Mr. Strickland has prepared the following reply, copy of which he has forwarded to the Electrical News.

Mr. Strickland's Reply

It is true that the commission submitted the first edition of proposed rules and regulations to a committee of the A.I.E.E., Mr. Hood being one of the members of that committee, and whether or not they re-submitted it to this committee should not be the basis of a discussion at the N.E.L.A., and any alleged breach of faith with the A.I.E.E. cannot possibly be construed as a breach of faith or one of co-operation with the N.E.L.A. As already explained there was no breach of faith anywhere that we can see, as the Commission certainly did not leave a stone unturned in submitting the rules to the electrical fraternity at large.

Mr. Hood then alludes to an alleged objection to the Hydro Commission having the power of administrating these rules and regulations, claiming that there will be a discrimination in the favor of municipalities in which Hydro power is used. Now, if it is in the interest of private lighting companies to have their electrical installations inspected and kept up to the standard, I would ask Mr. Hood, in the name of common sense, why the Hydro Commission plants are not just as equally interested. He refers again to a ludicrous situation being developed in an appeal to the Commission in a case of dispute, owing to the fact that the Hydro Commission are in a measure partners with the municipalities, maintaining the inspectors. I am again at a loss to account for such a deduction, any more than it would be ludicrous to appeal to the magistrate of any one of the Hydro cities. For instance, we will suppose that a Hydro employee and a private plant employee are both summoned before a magistrate in a Hydro town for some offence; we will say, as an illustration, that of disorderly conduct, it would be just as reasonable to assume that the magistrate, being employed by the Hydro municipality, would dismiss the Hydro employee and fine the employee of the private corporation.

We now come to that part of Mr. Hood's comments where he compliments the Commission on their excellent rules and regulations. I really feel that this is the heart of his address, because at one sweep he says that the Commission are to be congratulated on their excellent rules and that they are a credit to them. For this compliment coming from such a well-known authority as Mr. Hood, and from the ranks of the enemy, we feel very much gratified, as a lot of time and thought has been expended in producing a set of regulations which will be at least as good as anything we have at the present time. Touching upon the next comment, regarding the grounding of neutrals, Mr. Hood claims that we have done well in this respect, but stopped a little too soon to make a good job of it. There is only one answer to make to this comment and that is, this,—it would not be advisable to suddenly introduce a lot of sweeping changes, although there may be further developments to be looked for before long. There is nowhere in our rules and regulations that the Commission claims a finality to their regulations, and they certainly do not intend to stand still and let the grass grow under their feet, but will keep all rules and regulations well up to the times.

The next comment was the grounding of secondary distribution systems. Mr. Hood claims that the "sky limit" has been placed on this method of grounding. I can only say that the sky limit is rarely ever used on secondary systems and there are few, if any, in this country where the differences in potential exceeds 150 volts. Mr. Hood, however, only refers to this as a slight discrepancy, and if there is anything wrong with it it is a National Code rule and not a Hydro rule and he will have to blame the Fire Underwriters as the authors thereof. Regarding his comment on 2500 volt insulations in service pipes, Mr. Hood says this will be detrimental; but as he has failed to say in what way it will be detrimental I have nothing to answer. So far as I can see it only makes matters a little better than they are at present, and has a tendency to prevent the dangerous burnouts, a good example of which can be seen illustrated in our book of rules and regulations, and which, no doubt, is very fresh in the memory of Mr. Hood.

Regarding the protection of meters and the relative position of main switches, I can only answer this criticism by stating that it is a National Code rule, and that whatever the merits of Mr. Hood's criticisms may be, we did not at the present time deem it advisable to make any rules which were a direct violation of the National Code.

We quite agree with Mr. Hood that the National Code rule is somewhat behind on this point, and we will undoubtedly be able to find a remedy for this difficulty sooner or later. Mr. Hood refers to the question of placing a circuit breaker in the grounded pole of a generator. He states that we do not permit a fuse in a grounded neutral, and yet require it in the ground pole of a railway generator. This is a National Code rule also. When I first saw it I concluded that there was something wrong about it myself, but have before me the correspondence between the Commission and the Underwriters Committee of Boston, in which they defend their claims for the rule, so that at the present time we had no option but to leave the rule as it stands in the Code. (Edition 1913, not yet printed). These seem to be the chief points in Mr. Hood's criticisms, and I would summarize the situation as follows:—

At the very meeting, at which Mr. Hood was present, already referred to, one of the chief points raised, and unanimously agreed to by all present, was that the Commission be requested to rearrange their rules and regulations in such a way that there would be no confliction with the National Code of the Underwriters. I was present at this meeting, and Mr. Gaby, who was there also, promised the members of the committee that the book would be redrafted along the lines of the N. E. code. This has now been faithfully carried out, and all the violations of the N. E. code which were in the original book have been corrected. It now seems strange that when the Commission have so faithfully carried out the request of this committee, of which Mr. Hood was a member, that they are charged by one of the committee with having done the very thing which the committee and Mr. Hood requested them to do, and let me assure the readers of this magazine, and members of the N.E.L.A., that it has always been the wish of the Commission that the rules and regulations shall be approved and acceptable to the electrical profession as a whole, and it has been my earnest desire to not only carry out the wish of the Commission but to see that the book of regulations is a credit to my employees, and also as effective as any other similar edition to be had anywhere.

We have now before us the unqualified approval of the Electrical Associations of this Province duly signed by men who are members of the N.E.L.A., and Mr. Hood's adverse comments and charges of breach of faith were somewhat like a bolt from the blue; but let me assure him, however, that we are quite prepared and it is to be expected that there will always be somebody who may raise suggestions or comments. These are always welcome and will be placed on file and seriously considered from time to time, but in view of the fact that the Commission have shown their willingness to consider every interest at stake we hardly looked for a rap of this kind. It is, however, a source of gratification to know that in all the criticisms which Mr. Hood has

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The Purchase of Coal Under Specification

Within Recent Years Purchasers are Regulating the Quality of Coal by Specifications and Tests—Useful Test Data

By Mr. J. A. Copp*

It is only within very recent years that purchasers of coal have regulated the quality supplied them by the formulation of specifications and by systematic inspection testing. Buyer and seller had previously looked upon coal as a gross commodity, and it was bought and sold largely on reputation.

Trade or brand names were a valuable asset in selling; and frequently the reputation of a trade name or brand lasted long after the deposit of coal, upon which the brand had originally been established, had become exhausted, or had changed materially in character as the coal was obtained from deeper or more distant parts of the workings. The mining companies did not generally employ chemists to make regular analyses of the output of their mines; and about the only knowledge they had of the composition of the coal they were mining was of the most general sort, obtained either from the records of analyses made by the State Geological Surveys, or from occasional reports by customers. That the coal from different mines varied greatly in composition was well known, but it was recognized that the miner could do little to change his output. In fact, all he could do was to exercise care in mining, and to remove the foreign matter mined with the coal; and, by this care and preparation keep down the ash and sulphur toward the minimum which could be expected from the output of any given mine. The buyer was welcome to all the information the seller possessed, but it was too little to enable him intelligently to make selection among the various kinds of coal offered him at a rather wide range of prices.

A typical analysis of bituminous steam coal may be quoted.

Moisture	2.05%
Volatile matter	23.63%
Fixed carbon	69.36%
Ash	7.02%
	100.00%
Sulphur	1.25%
Thermal value	14,540 B.t.u

The moisture is more or less accidental, and may vary with so many circumstances that for most purposes it may be disregarded, being set down for information only. It is of moment only when the unit of delivery is a wagon or truck, and when the coal is weighed as it is being delivered. The proximate composition is then given on the basis of "dry coal," as representative of the coal as it really exists free from the accidental moisture. The sulphur must be separately stated, since it may be either in the volatile matter or in the ash, or more likely in both.

The volatile matter is mainly combustible, although a certain proportion is generally inert. It is of interest chiefly because of its influence on the behavior of the coal as furnace fuel. The boiler-setting and furnace are frequently such that coal high in volatile matter cannot be burned economically, especially under forced firing, and without the production of a prohibitive amount of smoke. Coal high in fixed carbon (and hence correspondingly low in volatile matter) is more easily and uniformly burned under general conditions.

Ash is inert, and may be considered a direct expense. It is paid for at the price of combustible fuel; and, when in too great proportion, it interferes with air distribution throughout the fuel bed. When, because of composition, it is of a fusible nature, it causes clinker formation, the removal of which necessitates undue prolonging of the time of opening of the furnace doors, with consequent loss of heat. Its removal and disposal is a supplementary expense.

Sulphur may exist in a free state, in which case it is relatively unobjectionable, but it is usually in combination in the ash and may increase the clinkering tendency of the coal. By proper care in preparation both the sulphur and ash can be kept down to as low a point as is possible with the coal from any individual deposit.

Considering coals of proximate composition and general character such that they may all be burned with substantially equal ease in a given furnace, their theoretical fuel efficiency will be in direct proportion to their thermal values, usually expressed in British thermal units (B.t.u.).

These data obviously make possible comparison of coals from different sources and, when supplemented by the results of practical experience in the burning of various sorts of coal in any particular installation, afford a means of estimating the relative value of coals of different character as fuel for that plant. Hence the analysis and thermal value form an excellent basis for purchasing specifications; and such specifications, having been found mutually helpful to buyer and seller for all other sorts of materials, have come into use for coal.

The specifications first prepared, and many of those in force to-day, fix the proximate analysis of the coal desired, and provide for payment of the coal delivered on a sliding scale above or below the base price as quality varies, and especially as the thermal value exceeds or runs under the figure fixed in the specifications as the standard. This form of specifications, however, is inflexible, and does not permit consideration of coals which might be excellent fuels, but would not meet the fixed requirements. Such coals either would be rejected for not conforming to specifications, or would be penalized prohibitively in price. Furthermore, it must be recognized that geographical location determines to a large extent the character of fuel that is available at any particular point. This follows from the fact that the distance from the coal fields and transportation facilities fix pretty closely the district from which coal for that locality must economically be drawn: if brought from other districts, the freight charges will be too high. In localities at considerable distances from the mines, the freight is from two to four times the cost of the coal f.o.b. mines. For these reasons many specifications have been so drawn that the bidder states the average ash, sulphur, B.t.u's., etc., in the coal he proposes to furnish, and this statement becomes the basis of quality.

In all of the specifications with which the author is familiar, adjustments in the price to be paid for coal delivered are made for variations in quality. In this respect, coal specifications differ from those used for the purchase of any other material, except, perhaps, pig iron. Such adjustment is necessary because it is seldom easily possible to reject coal, since in many cases the delivery has been unloaded, and may even have lost identity by the time the analysis has been made. A delivery poor in quality must usually, therefore, be accepted; and it is but just and fair that the price be lowered in some degree, commensurate

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with the lowering of grade below that contemplated in establishing the base price under the contract. An increase in price is equally merited if the delivery is of materially better quality than the standard.

The variations in quality to be provided for are, then, in the percentages of ash and sulphur, occasionally also of volatile matter, and in the thermal value, or B.t.u's. There are many ways of providing for adjustments in price because of fluctuations in quality. The majority of the specifications are based on the assumption that the price should rise and fall directly with the thermal value. Hence, taking the base price and the established standard of the contract, there are calculated the number of B.t.u's. for 1c. in a ton of coal at base price. The price of deliveries is modified as the analysis shows B.t.u's. higher or lower than the standard. A further modification is made for ash, sometimes by a scheme of proportion, sometimes by fixed deductions or additions according as the ash exceeds or is under the standard by fixed amounts or ranges. Adjustment is usually made for sulphur by fixed deductions for stated amounts or ranges by which the sulphur exceeds the standard.

Price Varies with Heat Value

Theoretically, the direct variation of price with variation in thermal value is correct. It is based, however, on the assumption that the actual fuel value varies directly with the thermal value. It is obvious, however, that it is not practically possible to realize the gain or loss in a power station from relatively small changes in B.t.u's. in the coal, because there are too many other uncontrollable variables to be taken into account. Certainly the stoker cannot take such changes into account, and its operation cannot be regulated accordingly. Furthermore, such fluctuations in thermal value as are found in shipments of carefully mined, well-prepared coal from any given mine are accidental and beyond the control of the miner. Naturally it is preferable to be able to sell one's wares at a fixed price throughout the life of a contract, and there is a certain minimum below which the sale is not profitable. The tendency, then, is for the price to be set so that any penalties which may be incurred will still leave a figure above this minimum, notwithstanding the fact that the law of averages would indicate that premiums and penalties would balance if the standard had been fairly set at average. The same lack of fixity in price leaves the buyer uncertain as to his costs; and, whenever premiums are earned, he is left in doubt as to whether he is actually getting his money's worth. He seldom can show it by lessened coal consumption or increased steam production. This same reasoning may be applied in large degree to ash, sulphur and volatile matter.

Before discussing further the question of price adjustment under specifications, it may be well to turn attention to an equally important matter. Obviously, the successful application of any form of specifications depends wholly upon the ability to obtain samples which represent fairly the quality of the coal delivered. Much has been written upon the question of sampling coal; and the difficulty of obtaining by hand a truly representative sample of, say, a carload or barge of coal is admitted. A second sample to check the first, in case of dissatisfaction with results, is usually not possible for the same reason that coal can seldom be rejected—it has been burned, or at least has lost identity, by the time results are obtained. An automatic system by which samples are obtained from all parts of the unit of delivery, whether car or barge, and which takes out a large number of thoroughly distributed small quantities, yields about as fair and representative a sample as can be obtained.

A third point requiring consideration in preparing specifications for the purchasing of coal is the unit of analysis. In cases where the contract is filled by a few deliveries over a considerable period, the delivery itself may conveniently be the unit of analysis, and the price to be paid for each delivery may easily be determined. Similarly, if the unit of shipment is a large barge or lighter containing several hundred tons, the unit of analysis may well be the unit of shipment. But where deliveries are in carloads of approximately forty tons each, and where the normal rates vary from four to perhaps twenty cars per day, depending upon the way shipments are made and the requirements of the buyer, it is seen that some scheme must be worked out to take care of wide fluctuations in receipts. The matter may be complicated by shipments coming in from two or three or more contractors at the same time. In such a case, which is by no means rare with industrial establishments, the laboratory cannot possibly be flexible enough in equipment with men and apparatus to handle analyses upon samples from each car as a unit, and provision must be made for sampling and analyzing at such intervals that the work may be carried out under commercial conditions.

The industrial establishment with which the writer is connected has studied the problem of coal specifications for several years, two or three different types of specifications being tried out in the course of evolution. In the specifications last adopted are embodied several schemes which are novel, and which have solved the difficulties discussed in a manner which has worked out very satisfactorily.

First, with respect to the standard, the contractor states the average composition and heat value of the coal to be delivered; and agrees "that this average composition and heat value shall be the standard basis of quality of the coal delivered." No restrictions upon either chemistry or thermal value are imposed in the tenders, but bids upon any coal offered are considered. Acceptance or rejection of bids is based upon the quality guaranteed and the price quoted.

Second, sampling and analysis. Samples are obtained automatically from the cars as they are unloaded at the power stations. The coal drops from the car into hoppers, discharging through rolls by which the coal is crushed before being conveyed to bins feeding the stokers. In one station the sample is obtained by the opening of a small trapdoor in an incline down which the crushed coal slides to the conveyor. In the other station, where the crushing rolls discharge directly onto the conveyor, the sample is taken by a small one-bucket conveyor, or "thief," which dips a small amount of coal from a conveyor bucket at regular intervals. In either case the sample is dropped to a receptacle which holds the entire 180, more or less, little portions that are taken from all parts of a car. This sample is then passed through a grinder by which it is reduced to about 16 mesh and finer, and then put through a mixing machine. Any reasonable portion of this 40-lb. sample is then as thoroughly representative of the car as it is possible for any sample to be. A 2-oz. sample is taken from this car sample to represent the car in the final analysis. The 2-oz. samples from all of the cars sampled during any calendar month, and representing the delivery by any one contractor, are then thoroughly mixed and quartered in the customary manner until a final average sample of about one pound remains. "This final average sample shall constitute the sample upon a portion of which analysis, shall be made to determine the average character of the coal received during the month, and upon which settlement shall be based." In this way the utmost flexibility is provided for handling the greatest variations in the number of cars delivered.

Third, basis of settlement. No clearer idea may be given for the provisions in the specifications for adjustment of price for variations in quality, than by direct quotation:

Settlement for Coal

"Settlement for coal received during any calendar month shall be made after the completion of analysis of the average sample representing coal received during said month, and not later than the fifteenth day of the next month. The price

per ton to be paid by the purchaser shall be the base price quoted by the contractor, with deductions and additions for variations in quality, and for failure to deliver in drop-bottom cars, as hereinafter provided."

"When the analysis upon the average sample for any calendar month shows that the percentage of ash is not more than one higher or lower than the standard average percentage, and that the percentage of sulphur is not more than 0.25 higher than the standard average percentage, and that the thermal value is not more than 150 B.t.u. higher or lower than the standard average B.t.u., then settlement for the coal received by the purchaser during said calendar month shall be made at the base price, without additions or deductions for quality. When the analysis shows that the percentage of ash is more than one lower than the standard average percentage, then an addition of 2c. to the base price per ton will be made for each 0.50 or fraction thereof, that the percentage of ash is more than one lower than the standard average percentage; and when the analysis shows that the percentage of ash is more than one higher than the standard average percentage, then a deduction of 2c. from the base price per ton will be made for each 0.50, or fraction thereof, that the percentage of ash is more than one higher than the standard average percentage. When the analysis shows that the percentage of sulphur is more than 0.25 higher than the standard average percentage, then a deduction of 2c. from the base price per ton will be made for each 0.25 or fraction thereof, that the percentage of sulphur is more than 0.25 higher than the standard average percentage. When the analysis shows that the thermal value is more than 150 B.t.u. higher than the standard average B.t.u., then an addition of 1c. to the base price per ton will be made for each 50 B.t.u. or fraction thereof that the thermal value is more than 150 B.t.u. higher than the standard average B.t.u. When the analysis shows that the thermal value is more than 150 B.t.u. lower than the standard average B.t.u., then a deduction of 1c. from the base price per ton will be made for each 50 B.t.u. or fraction thereof that the thermal value is more than 150 B.t.u. lower than the standard average B.t.u."

Specifications founded on Average

It is seen that the specifications are founded upon averages, and the idea of averages includes a certain expected variation. The record of a large number of analyses made over a period of several years has shown that the limits set in the specification, within which there are neither additions to or deductions from the base price, are sufficiently wide to cover the variations that should reasonably be expected from carefully mined and prepared coal, at least from the district from which coal is customarily shipped to Schenectady. At the same time, experience has shown that acceptable coal which falls within the limits of the "base zone" of the specifications is good commercially acceptable fuel, and that there is no warrant for any change in price of coal which does not vary more than the limits to the "base zone." Coal which does vary more than these limits is either of distinctly better quality and should earn a better price, or of markedly poorer quality meriting a reduced price.

The object of purchasing specifications is two-fold: first, protection against unscrupulous or ignorant competition, by insuring a common basis for all bidders; and, second, the provision of standards by which deliveries may be evaluated, thereby insuring the acceptance of good material and making provision for the rejection or other disposition of that which is below the standard established. The standard established, then, should be such that, while it is high enough to insure safe and satisfactory service in the use for which the material is intended, it may be reached by recognized commercial methods of making and marketing. The specifications should provide a continuous supply of satisfactory commercial material at the lowest price at which such material can be furnished; and, during the term of the contract, there should be as little disturbance as possible either in quality or price. The specifications quoted were drafted to meet these conditions; they call for good commercial coal for which a fair price is to be paid, and make provision for an adjustment in the price only under what may reasonably be called extraordinary conditions. Purchases made over a period of over three years under specifications embodying the principle of the "base-zone" have shown their fairness by the fact that settlements have been made at base price in the greatest number of instances. Obviously, the bidder must state his "standard average" fairly and correctly. If the quality is set too low in the hope of getting additions in settlement, the price will be too high to be consonant with the quality offered. If the bidder sets his quality too high, so as to make and attractive looking bid, he is automatically paid a proper price when his delivery is poor. Furthermore, privision is made for concellation if a contractor continuously furnishes coal warranting deductions of 4c. or more per ton. When the standard average is properly stated, both buyer and seller may count upon the delivery of good coal at a fixed price.

During the next few months the C. P. R. telegraph department will string 775 miles of new wire on the western lines. Calgary is to be the central point for the lines to all parts east and west of the system. By the close of the summer the company will have 2,280 lines of its principal track in western Canada operated by telephone. The wires will be used from Calgary for this purpose in the near future.

A Prussian Government Water-Power Project

(continued from page 39)

installations for this final distribution is roughly estimated at $3,300,000 to $3,800,000 or on the average about $238,000 for each county.

The investment by the State includes the generating plant and the high-tension transmission system. The original bill laid before the legislature appropriated for this purpose $2,142,000, of which $1,190,000 was to be expended at once and the balance when the construction of the station at Munden was taken up. On this basis it was expected that the State would realize on its investment somewhat less than 2 per cent. in the beginning and 6 per cent. when the fifth stage of current consumption was reached. The bill was amended by increasing the appropriation $357,000 for use as the need arises for extending the high-tension transmission system to other counties and cities desiring to purchase electricity from the State. The return which the State may realize on its investment is limited by law to 6 per cent. Any further surplus must be devoted to the reduction of rates. The counties, it is calculated, will be able to realize under the proposed terms an average of 5.25 per cent. on their investments.

Mr. Strickland's Reply

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made there is not one word against our own production, as they are entirely directed against rules which have been adopted at the request of the electrical interests from the old National Electrical code. In conclusion let me assure the parties interested that bona fide suggestions will be received at all times, and as soon as the system of inspection is well organized we feel that the electrical fraternity at large will have every reason to feel that the interpretation and administration of the rules and regulations will be carried out in a fair and impartial manner, and that there need be no apprehension that the electric lighting companies are going to get a raw deal. I hope, therefore, that this reply to Mr. Hood will have a tendency to clear up this slight controversy and all will be well that ends well.

Organization of an Appliance Department

Under present-day conditions the dealings of distributing companies with their customers carry heavy obligations.

By Mr. B. E. Rowley*

It has been stated at light and power companies' conventions that under present day conditions the dealings of companies with their consumers carry obligations and responsibilities far beyond anything dreamed of in the old regime.

If it is your desire to build up and foster a spirit of friendliness and confidence on the part of your consumer it is essential that you take the initiative.

When through your representatives you give smiling greeting to every one of your patrons it will go fully as far toward establishing the relationship you desire as will a cut in lighting rates.

Make your appliance salesman a part of your "service."

Your appliance salesmen, through self interest, are certain to be liberal with their smiles and keen at overcoming any prejudices against you.

You might emphasize your attitude of friendliness by instructing them to make careful note of complaints and see that the proper department follows and adjusts them.

During the winter months particularly, fifty per cent. of the women are telling their neighbors that their light bill is outrageously high. At least forty per cent. of this number may be convinced to the contrary by a man who has been properly coached.

Much irritation is caused, unknown to you, by hurried supply clerks in answering complaints and in talking, more particularly over the telephone, with unreasonable customers.

This unfortunate frame of mind on the part of the customer may be largely corrected by a salesman whose first effort, if he hopes to make a sale, must be directed toward convincing his customer of the friendly attitude of the company and in getting her in an amiable frame of mind.

Just recall the time and money you have spent or may yet spend in moulding public opinion on these phases of your business; revision of rates, poles vs. conduits, franchises, tax assessments, municipal ownership and, incidentally, appraisements, competitive companies, pole permits and regulations, objectionable ordinances and other vexing problems.

The determination of all of the subjects is either affected or influenced by public opinion.

If you employ the right calibre men for a house to house canvass and they are properly instructed, the day is certain to come when at a critical point their efforts will have turned the scale in your favor, and then, just for good measure, they are actually making revenue for the company while so engaged.

Demonstrations

Public demonstrations are profitable as they educate the ladies in the use of appliances and are the means of making many sales.

A large attendance can always be obtained by sending out numbered announcements and offering one appliance free to the lady who has the prize-winning number. These announcements have printed upon them a list of appliances to be demonstrated and the invited guest is instructed to mark with a cross the one she prefers. She then signs her name and address and these cards are collected upon her arrival and at the conclusion of the demonstration the prize is awarded to the one holding the fortunate number.

These cards are later distributed among the salesmen and are used as leads for future business. If this plan is followed in conjunction with an active house campaign each will help the other and the returns will be highly satisfactory.

A demonstration of appliances makes an impression that will stick in the minds of those who witness it for many years. They are there made to realize the great strides being made in Domestic Science.

A half-hour talk should be given on the use of electrical appliances generally and followed by a practical demonstration by capable demonstrators of each appliance. Toast can be quickly prepared and served. Corn may be popped and passed around. Coffee making with a percolator always fascinates the spectator. A water heater will quickly start the water boiling so that it can be seen by all. Dainty fabrics should be ironed. A washing machine could be in operation. A Vacuum Cleaner should be a drawing card to the housekeepers.

An office demonstration of electrical appliances may be made specially interesting if held in the evening.

You could adopt the plan of asking dealers to furnish ornamental lighting fixtures and lamps for a lighting display to be made at the time of the demonstration.

This gives the dealer an opportunity of obtaining new business, encourages a more elaborate lighting system in houses and brilliantly illuminates your display.

If you have in your company or in your employ a man who can deliver a short address on correct and economical lighting plans for residences and who will discuss the history and theory of electricity as applied to cooking and heating appliances, it will help make the evening profitable for those who are present.

Music and a few flowers will help make the occasion noteworthy and the cost would be nominal. You will find that a demonstration of this kind will justify considerable space in the news columns of your local papers.

Terms of Sale

The perpetual earning capacity of the Appliance Department is certainly sufficient to justify a lighting Company in occasionally giving it the benefit of the manager's personal attention. The routine work will of course be placed in charge of a man who may be called the Appliance Department Manager.

It has been proven that payments of one dollar down and one dollar a month on appliances will make it possible for every consumer to buy. Even people who have ample means will purchase more freely, knowing that they are obtaining the device at the right price and that it is seldom in business history that an article is sold on the installment plan without advancing the cost to the buyer.

These monthly payments will be handled through your collection department by attaching a separate bill to the meter statement, or as explained under the next heading.

The life of the heating elements will line up to the guarantee of any reputable manufacturer, so you are assuming no risk in making the most of this convincing selling point. In this connection it has been found that if the apparatus is treated with ordinary care the heating element will be in use at twice the guaranteed age. This is not a theoretical asser-

* Presented before the C. E. A. Convention.

tion, but is based upon actual experience covering a period of years.

The Ledger Account

Some Central Stations carry the appliance or merchandise account on the same ledger folio with the current, others prefer two separate books.

Where the Loose Leaf System is adopted a smaller and lighter weight ledger sheet for appliances may be used and when placed in the binder it will always be found directly above the ledger sheet upon which the customer's current account appears.

The keeping of separate accounts permits of analysis in order that the true percentage of current and merchandise may be shown.

In billing, some companies prefer issuing a separate bill for appliance installments, attaching it to the meter statement for collection.

Others contend that it should all be included in one bill, for the convenience of both the customer and the Company's bookkeeping department. It has also been noted that the customer is not then likely to make a payment of less than the full amount of the bill.

Employment of Salesmen

Frequently young men working in the Central Station offices show a natural aptitude for salesmanship. Their services would double in value if they were taken from the desks. Men with ability for this work should be seized upon and developed.

College men usually have the personal appearance and mental training that specially qualifies them in selling appliances to the housewife.

Many young college men have taken up this line of work during vacations and have been so impressed with its possibilities that upon leaving school they have again entered the field.

High school boys of the present day can assume a manly attitude that pleases the lady at the door and she will frequently admit him for an appliance demonstration in her home when older men would be refused.

A foundation for the boy's interest in electrical appliances may be laid by donating two or three devices to the school Domestic Science Department.

This gift will redound to your benefit in more ways than one. It adds new interest to the teacher's work, consequently she will be appreciative. The pupils spread the news at home and parents are thus convinced that the day of electrical cooking has arrived.

The Y. M. C. A. employment bureaus sometimes have recent arrivals seeking positions.

There are many good salesmen in stores who are bent on finding an outlet for their ambition. Some of them would be glad to accept an offer from the Central Station for out-of-doors work.

Manufacturing Companies of heating apparatus may also be in a position to suggest the name of an experienced salesman who is open for employment.

Lighting and power companies have found that while an office display of electric appliances brings returns, a house to house canvass is much more effective. These two plans of selling should both be followed to obtain the best results.

In employing a solicitor it is important that he be fitted for the work. He must have a ready smile, be neat in personal appearance, and a man who specially enjoys winning his game.

Good men frequently object to canvassing but this distaste can be overcome if the facts are presented in the right light.

In the first place the lady at the door gives a cheerful greeting to a man who announces that he is employed by a company with which she already has business relations. This at once differentiates him from the ordinary solicitor. Again women are invariably interested in electric appliances as they are handsome, stand for cleanliness, and are time-savers. They represent modern methods, the very latest improvement in housekeeping conveniences.

The possibility is great of a salesman making more than ordinary wages. It is simply a matter of putting in full time and conscientious work.

Obtaining Results

It is inadvisable to send a man out with more than one appliance at a time, but he should have with him cuts and prices on the complete line. After he has studied the literature and sales-talk furnished, his constant hammering on one appliance so familiarizes him with his "stock talk" that while giving it he can be studying his prospect. He will then be ever alert to seize the psychological moment for closing the sale.

Solicitors by occasionally changing the appliance will prevent their work from becoming monotonous and will have an article of fresh interest to show the consumer when the next call is made.

You will find that the demand for coffee percolators, grills, toasters, etc., will be just as great as it has been for irons. Take, for instance, the coffee percolator; coffee is made at least once a day in nearly every household, indicating that every one is a possible buyer.

Furthermore, half the housewives have already expressed their wish that they had a good percolator. The many advantages of the electric pot over all others are so apparent that it doesn't require much time to convince a prospect. The electric iron has paved the way.

Now arises the question of price. We realize that in most cases it is necessary to make a special inducement in order to effect a sale at the door.

It is our opinion that an offer of "easy terms" is all that is required; a lighting company is so situated with reference to its consumer that it can extend credit without assuming any great risk. Ordinarily they have either a cash deposit or references and collectors are in constant touch with consumers.

The merchant is not so fortunately situated, nor can he put all of his profits back into advertising and selling and still come out ahead of the game.

We wish to urge upon lighting companies the desirability of maintaining good terms with the dealers.

There is no question that the dealer has his circle of friends and customers in a community who would prefer dealing with him. A word from him will frequently prevent many from buying and he is prone to "knock" when in competition with the lighting economy.

It has been found that women discuss electrical appliances they have with their friends with great zest. This neighborhood discussion, coupled with liberal advertising, calls of solicitors and co-operation of dealers, will stir up a surprising demand.

Above all, weigh with care the merits of a line of appliances before placing them with consumers. Dissatisfaction kills the demand just as quickly as a meritorious article will build it up. Cheap goods will sell but there is an aftermath that will put your nerves on edge.

Liberal advertising will make heating appliances a household byword. Then salesmen will not have to spend time in convincing a prospect that they are offering a meritorious article. It is working along the lines of least resistance. There is a certain lighting company that has put out 8,000 percolators and only 150 came back.

Compensation

In the employment of salesmen it has been found advis-

able by some companies to place them under a small bond.

The reason for this is that the men collect considerable sums of money, both from those who do not wish to take advantage of the installment plan and from those who make first payments.

It is wise to hold up the application for a bond for at least a week in order to determine if the man is qualified for the position and if he is liable to stick.

The bond is paid for by the company, the charges being small.

If you follow the plan of making a monthly deduction from salaries to cover sick benefits and insurance, include these salesmen; make them feel that they are part of the regular office corps.

Numerous plans of payment for services rendered in selling appliances have been tried out. Some salesmen prefer being paid a liberal monthly salary and a small commission on sales. The advantages in favor of this system are:

Good men frequently hesitate at leaving the positions they have and start work on a commission basis. To them the plan is new and untried.

If a capable man works conscientiously with your consumers you are deriving a benefit other than that received from his direct sales. People may not be prepared to buy at the time they are approached, they may buy later at the company's office or they may close with the next salesman who calls, because of the efforts of the first man.

The fact of someone other than the unwelcome collector calling from your office, meeting the customers with a friendly smile and convincing them, if necessary, of your good will and responsibility as a guarantor, ties those consumers to you with a personal bond that you have not before enjoyed.

So we affirm that if your salesman at the end of the month has not made many sales and throws up his hands, you are not a loser and will eventually derive full benefit from his labor.

Another benefit in the larger monthly salary lies in the fact that men will at least give the position a month's fair trial.

In this, as in any other vocation, experience cannot be developed in a day and first efforts are frequently disheartening.

Under these circumstances, some men, if working on commission solely, will quit, whereas a few weeks' experience would have brought them out on top.

One more reason in favor of this plan is that salesmen will give more careful consideration and attention to orders from the office and will not be so frequently tempted to make misrepresentations in order to land a wavering prospect.

The considerations in favor of the large commission and small salary, or none, appear to be: More aggressive work on the part of some solicitors who set a mark, and the natural automatic adjustment of salaries to correspond with the abilities of the salesmen.

Commission should not be paid until you are fairly certain that sales will stick; one week after delivery should at least elapse before payment is made. Returns, after commissions have been paid, must be deducted from later earnings.

Guard against abuse in taking back appliances. Some customers will use a heater during the spring and on a trivial complaint attempt to turn it in for a fan in the summer. Dealers avoid returns and still hold their customers; you can do likewise.

Don't be discouraged by frequent changes in your selling force. Keep in mind the realization that every appliance you sell will for years to come be earning you that little old fifty cents a month.

It has been estimated by one of the large lighting companies of New York that six months' returns from a lighting contract is a fair expense allowance for securing new residence business.

Assuming that an average residence connection will bring in a revenue of $18 a year, which is low, then $9 would be the cost of obtaining the contract.

Upon that same basis an electric appliance will give a revenue of $6 a year and $3 would be a fair selling cost.

You will also remember that this selling cost on a large number of appliances on your lines is borne by the dealer. Add the profit you make on the sale of an appliance to $3, the amount you would be justified in paying, keeping constantly in mind the fact that this makes for a day-load, and you will realize that you can afford to pay a big salary to a big man.

Don't count the cost when you have your eye on a live salesman or the making of one, nab him on the spot.

Frequent Meetings

Salesmen should frequently be called together for a comparison of ideas and experiences.

If regular meetings are insisted upon it will grow to be a matter of routine to which no objection will be raised.

That interest may be added to these meetings, have your men take turns in going through the form of selling appliances to one of their number who will offer the usual objections. It will sharpen up their wits. At the conclusion of the test invite criticisms.

In starting out new men load them up with literature and salestalks. It is not necessary that they repeat it parrot-like, but it gives a foundation, a starting point, upon which to build. Before they are permitted to go out see to it that they are examined and properly qualified.

If men spend time and thought in preparing for this work they will convince themselves that they have a good article and will not be so easily rebuffed.

If you think it best to first send them out with an experienced man see to it that you select one as in instructor who isn't inclined to "knock." Those who go out with new men should realize that when all of the men employed are doing a good business the department takes on an added importance. They will be more liberally helped with advertising and the manager will be more disposed to increase the commissions.

When Salesmen Grow Stale

The time usually arrives with salesmen when they have the impression that they are past masters in the selling game. If orders are not coming in to your satisfaction these men promptly affirm that the trouble lies either with the appliance or the territory they are covering. As a matter of fact they may be growing stale in their selling methods.

The best plan to disabuse their minds of this impression is to call a series of meetings and invite travelling men or local salesmen, in other lines, to address them.

They will soon discover from these talks that there are many schemes for bringing about a sale that have never occurred to them.

The automobile salesman is always up against the keenest competition and has many a tough nut to crack.

He usually is willing to address these meetings as it gives him an opportunity of advertising the merits of his car with men who are in constant touch with the public.

Have your lighting and power contract men and office force attend these meetings. It will have a tendency to ginger them all up to a better efficiency.

When a salesman has not been successful in his district his failure may be due to a personality that doesn't please the class of people living in that locality. Try him somewhere else and he may do exceptionally well.

Encourage the men in studying literature describing

competing appliances. If an opportunity offers have them examine their construction.

Do not hesitate over having them make frequent calls on the same consumer.

These people are finally impressed by your persistence and continued enthusiasm.

Under present business conditions trained men are displacing those who have but a superficial knowledge of their business.

The science of selling will always afford an interesting study and men who succeed will be greedy for knowledge that they can utilize in their work. Your best men will derive greater pleasure from achievement than they will from the size of their pay check.

A Preliminary Step

If before a salesman is sent into a certain field, advertising matter is mailed to consumers, followed a few days later by a circular letter, it will greatly facilitate the efforts of you representative.

This letter should be sent a day or two before the solicitor calls.

Thousands of dollars are paid out by firms introducing specialties for mailing lists. A large percentage of the names they secure are not even possible purchasers.

The list you have is invaluable for this purpose and should be used to the limit.

Let your letter read something like this:

Dear Madam:

We sent you a few days ago circular matter describing our Electric Coffee Percolator.

We have tested from a practical and mechanical standpoint the various appliances of this character now on the market and unhesitatingly recommend this Percolator as being the mose serviceable and economical coffee pot.

This selection was an important matter with us as we hope to have you on our consumer's list for a number of years to come and we do not want any dissatisfaction to arise because of our recommendation.

One of our salesmen will call upon you shortly for the purpose of demonstrating this device and we ask that you give him a few moments of your time as we are making a special offer that will be well worth your consideration.

Yours very respectfully.

Sales Women

It has been found in some instances that women are more successful than men in selling appliances.

One of the best methods of operation for them is to make telephone appointments in advance. This plan gains immediate entrance to the house.

They having used gas and stove utensils will speak with the conviction that comes from experience when comparing them with electrical appliances.

A Salesman's Incentive

The success or failure of your appliance department will depend largely upon the character of the salesmen you employ. Some good men may be obtained from other lines of employment if you make your offer sufficiently attractive.

Remember that there is a prejudice against house to house canvassing that you must overcome—make your call for salesmen, not solicitors or canvassers. We know of instances where appliance salesmen have drawn as high as $400 in commissions for a month's work, the possibilities are there if you obtain the right man.

If you haven't time to present the offer to the man you have in view as it should be presented, give him a copy of the following letter.

We think it will appeal to youg men who are in the rut and haven't had the nerve to get out and do things; men who are working ten hours a day for a pittance:

To Salesmen

"This letter is addressed more particularly to men who feel that if they had scope for their activity and ambition, they would accomplish things worth doing.

You will agree that the first requirement is forming a connection with a company well capitalized and likely to grow even in advance of the community in which you are living.

Once get your foot on a rung of the ladder and if you are made of the right stuff, you will climb and your objective point will always be worth while.

There is scarcely a department in a lighting company organization where more immediate notice is taken of a live, intelligent, responsible man than in the appliance department.

The reason for this is two-fold. The sale of anything other than electric current by companies of this character is not usual, consequently results are being watched by every one from the manager to the office boy.

Another reason is that, in the past so-called outside men in every branch of business have in many instances proven themselves unreliable.

This puts a premium on the man who is reliable and "makes good," and he will find it the most profitable, agreeable and independent work he has ever performed.

It is a well-known fact that out-of-door work will improve a man's health and his mentality to the point where he will accomplish all that is in him.

We want first to impress upon you the fact that calling upon a lighting company's residence consumers is quite different from the house to house canvassing for subscriptions or silver polish that you may have in mind.

The company's name will be found the open sesame to the homes of their patrons for business purposes and you will find the interest taken in electrical appliances will surprise you.

Remember, too, that we pave the way with literature and letters, so that you will be introduced and expected.

Men in the appliance department have found that after a week's experience, six hours of hard, conscientious work will bring in greater cash returns than men of equal ability are earning, though they have been employed for years in what they considered good positions.

The observing man will obtain unlimited knowledge and entertainment from his work.

He weighs his prospect's character, determines whether he will first have to create a stronger desire or concentrate on quality, or prove economical operation. Frequently the first step is getting on a friendly basis by a way foreign to electric appliances.

A man's wits are kept on keen edge and after a month's work in the field, he will find himself better prepared to cope with any situation in his personal affairs requiring prompt mental decision.

When you are working on a commission basis and a line of action makes a dollar or loses a dollar on the spot, you will analyze your methods as you never have before.

Right here, we want to say a word on salesmanship generally:

It is the key to success in every man's life. The doctor must sell his professional services. Professional ethics may compel him to cover his tracks, but nevertheless his dress, his beard, his manner, his conversation, his social relations are all more or less determined by his idea of what makes the strongest pull for his services. And so with the attorney and even the young man contemplating marriage will find the attractive Miss sought by others and every element of sales-

manship will enter into his courtship though he doesn't realize it.

If, then, one's capabilities in this direction determine his future, why not get into a field where the highest degree of cultivation is possible; where your efforts stand or fall every half hour.

A good specialty salesman is in a position to demand the largest salary paid by business men. Big manufacturers are helpless without them.

The man who engages in this work will quickly discover that a smile will inevitably bring a reflected smile from his prospect and a kindly reception. Having this in mind, the good salesman fights off the feeling of grouchiness until it is foreign to his nature.

The advantage of this training over office or store work will be apparent when you consider that a man entering a store and asking for a particular article is an "easy mark" as compared with the one approached in his own office or home and there induced to purchase an article that he had not before desired.

Don't you see how much more instructive and interesting is the game under those circumstances? Go in with a determination to win; the returns financially will justify it."

Keep in Touch

Always remember that a word of congratulation when justified and a reasonable criticism when deserved, will do more toward holding salesmen than will a raise in salary.

This is particularly applicable to outside men. They are working under high pressure and need to be kept in mental balance.

The appliance manager who keeps in close daily touch with their work will greatly increase the output.

Sales Record

The form appended will be found useful in routing the salesmen in the field. It also supplies a complete record of appliances sold.

These forms should be printed on a lightweight index card of good quality. For convenient use they are filed by district in a cabinet.

If a salesman has occasion to use an alphabetical arrangement he can readily find the name he wants in your permanent records.

If you now have no arbitrary designation for districts a numerical classification will answer, the cards in each district also being numbered consecutively.

The names of the street or streets covered should be written at the tops of the cards and these with the consumers' names and addresses should be typewritten as constant usage on the streets tends toward making them illegible.

Index tabs showing streets or districts will be useful.

These cards are passed out to the salesmen each morning and upon them they enter not only sales made, but by using symbols they may indicate the preference of the prospective customer beneath the appliance wanted. An absolute promise to purchase when the next call is made should be carefully noted.

Care should be exercised in keeping the number of names given to each salesman down to a minimum consistent with thorough work. Salesmen are disposed to pick the easy ones and fail to give the more obstinate prospects the time they should have.

It is a good plan to furnish salesmen with black cloth, stiff back, side open, book cover the size of these cards. By using a heavy paper clip the cards can be secured to the back cover, thus preventing loss or defacement.

When one tenant moves, or another enters, change of name should be made on the cards.

If a number of salesmen are employed they should be kept on the same district. This facilitates delivery and enables the men to meet occasionally during the day for a comparison of notes. By this means, too, a friendly rivalry is fostered.

Office Display

An attractive office display of electrical appliances will augment the sales in a way that will convince you it pays.

Place a table or counter, with steps on it, against a side wall. Cover it with black velveteen and upon this display your articles, being careful about keeping them fresh and bright. Beneath the table place cupboards for reserve stock. Have cords in light sockets ready to attach to the appliances you are showing.

Your display may be made more impressive by adding a wall case with glass doors.

The table "Show" will bring the best selling results, as many visitors are more likely to purchase when they can pick up an article and examine it without calling a salesman.

A neat demonstrating table should also be put in and at the time of month when consumers are calling in the greatest numbers to pay their bills have a girl giving demonstrations of various apparatus. See to it that her selling arguments are just as sound as those used by the men and that she does her work in a pleasing manner. Also secure demonstrating appointments for her with cooking schools and women's clubs.

You will find that this display of appliances in your office will make it much more attractive to visitors and that the department will quickly gain your respect because of its earning capacity.

One method of advertising which results in bringing in business is to print descriptive matter and small cuts of devices on the backs of meter statements. They are certain to find the mark, and are usually kept on file by the consumer.

Newspaper advertising, particularly in the smaller cities, will help in making your demonstration and your soliciting campaign a subject of general comment among housewives. You can obtain from manufacturers cuts illustrating any of their appliances which you desire to feature.

Using a Social Function

This plan, more particularly in small cities, should work out successfully.

Select ladies who have an extensive acquaintance in the neighborhood in which they reside, and induce them to invite as many as possible to attend lectures on electrical appliances, and demonstrations, at their homes.

Let it be distinctly understood that no sales are to be made at the time, nor are prices to be discussed.

This defines the occasion as a social gathering, and the discussion of the electrical branch of Domestic Science will be found an instructive means of entertainment.

The lady at whose house the demonstration is held should be presented with an appliance without charge. This will usually be found sufficient as an inducement for her to make the affair a success in point of attendance.

A twenty-minute talk may be easily prepared, covering the application of electricity as a source of heat for cooking.

The demonstration should be limited to one or two appliances, but the other devices should be so described as to whet the curiosity of those in attendance to the point that they will express a desire to see them. As an example, an interesting exhibition may be given with a chafing dish and a percolator. Some dainty dish may be prepared on the former and coffee may be served from the latter. The idea then would be to describe other appliances in such glowing terms that every woman present would want to see them. This would give an excellent opportunity for other demonstrations.

The way is now opened for appointments at the various homes of those interested. These may be made at the time or later by telephone.

In some instances it might be advisable to promise the

lady in whose house the demonstration was held, a small commission on resulting sales.

The same plan, when applied to churches and social clubs, has proven successful, the inducing commission going to the organization treasury.

Young college men are specially qualified for this class of salesmanship, and they will find it highly congenial work.

Elec-tricklings

Make liberal use of the display cards furnished by manufacturers.

Salesmen should be posted on the relative merits of the various appliances on the market.

A display of appliances on a tea table always attracts attention and emphasizes the coziness of electric cooking.

Selling two appliances with but a single cord justifies a reduction of one dollar. This makes an apparent special price and results in the sale of more appliances.

A salesman without enthusiasm will not serve your purpose. He is like a lamp with a broken filament—appears all right until you try to electrify him. He will never light the way to success.

The Kansas Gas and Electric Company issued an attractive circular illustrating all of the electric appliances they handle.

The headlines read: "What ten cents' worth of electricity will do." Under each article was printed the statement of how long or how many times the appliance could be operated for ten cents.

In order that immediate orders might result, a coupon was attached which upon being presented at the office, was good for fifty cents to apply on the purchase price of any appliance shown.

Electric irons may be sent out on trial without much likelihood of their being injured by thirty day's use. It has been the experience of central stations that not over one out of fifty will be returned.

Hotels and cafes of the better class afford an excellent field for salesmen. There is an opportunity to put over a specially large order and incidentally the placing of appliances in such public places makes effective advertising.

In the morning it delights guests to either prepare toast themselves or to watch a waiter do so at the serving table.

The coffee percolator is an ornament to any table and gives ample assurance that the coffee will be fresh and good.

Evenings the chafing dish adds much to the pleasure of the lunch.

"The Cave," a fashionable restaurant connected with one of the best hotels in New Orleans, has a great number of these appliances in use, and the proprietor is delighted with his venture into the electrical field.

Men who are out on house-wiring campaigns and who are seeking new business are in a position to and will sell many appliances. Point the way and pay them in addition to their regular work, and there will be no question about results.

The Southern California Edison Company, of Los Angeles, Cal., has 80,000 consumers and over 90,000 appliances in use on their lines, which conclusively shows what intelligent effort will accomplish in building a day-load.

The Little Rock Railway & Electric Company installs in the street cars a small receptacle for folders. These folders are devoted principally to well-selected jokes, but the electric iron or percolator talk is present, and passengers with ample time on their hands are certain to read every line.

While making demonstrations at the homes of consumers a handful of pennies will sometimes help in clinching the sale. At the conclusion of the demonstration hand the lady a penny. She will very naturally want to know the reason for such munificence. Simply inform her that the penny will pay for all the electricity used while demonstrating an electric toaster, and that there will be a credit left over to be applied on the cost of a future cooking operation.

Some salesmen have successfully used this penny plan in selling percolators. They carry coffee with them and serve the prospect with as good a cup of coffee as she has ever enjoyed, at a cost of less than one cent.

A number of forms for use in the Appliance Department were appended.

Saanich Line Operating

The Saanich suburban line of the B. C. Electric Railway Company, connecting the city of Victoria with the northern end of the peninsula at Deep Bay, was formally opened by Sir Richard McBride, Premier of the province, on June 18, the inauguration of the line to traffic being celebrated with approximate ceremonies in which a large number of prominent Victoria citizens took part. Trains will run every three hours from the Douglas street terminal, to Deep Bay, the twenty-four-hour system, as is the case in the operation of the C. P. R. trains, being observed. While the service arranged is only a tentative one, in the sense that many improvements are contemplated by the management before it will be brought up to the standard which they hope to establish, it will at once provide transportation facilities which will materially aid in the development of the whole of the Saanich Peninsula.

Electric Interlocking

A hand-book published by the engineering staff of the General Railway Signal Company of Rochester, N.Y., with an introduction of Wilmer W. Salmon, President and General Manager of this company. The General Railway Signal Company have been pioneers in the manufacture and installation of Electric Interlocking equipment and the present handbook is published to meet the requirements of the many present and prospective users of their dynamic indication electric interlocking. In this handbook it is sought to furnish data that will be useful to all those seeking a true understanding of the dynamic indication principle and to those who are required to prepare bills of material for or to install, operate or maintain the electric interlocking equipment of this company. The handbook is well bound in leather covers, is divided into sections treating the various phases of the subject separately and with a complete index. A number of useful tables are appended.

Personals

Mr. W. Chase Thomson, M.Can.Soc.C.E., has opened an office in the new Birks Building, Montreal, where he will act as consulting engineer, making a specialty of bridges and other steel structures in which work he has had wide experience.

Mr. A. C. Towne has succeeded Mr. C. B. Ellis as manager of the electrical department of the Montreal branch of the Canadian H. W. Johns-Manville Company, Limited. Mr. Towne was formerly foreman of the electrical branch of the C. P. R. Angus shops, and put up the first wire in those buildings.

Mr. Charles B. Ellis has been appointed manager of the Economy Fuse and Manufacturing Company of Canada, Limited, with offices and warehouse in the Herald Building, Montreal. Mr. Ellis until recently was manager of the electrical department of the Canadian H. W. Johns-Manville Company, Montreal, and takes a very active part in electrical affairs in the city. The Economy Fuse and Manufacturing Company are organising branches in the larger cities of the Dominion.

Testing of Telephone and Telegraph Lines*

A Series of Short Articles Based on the Author's Practical Knowledge and Experience—Applicable to Plant of Any Size or to Any Manufacturer's Equipment

By Mr. T. H. Nicholson

The fact that in the regular type of the Wheatstone bridge a relation of values, rather than actual values, is used, is taken advantage of for many special purposes to simplify operations, especially where very accurate measurements are not essential but where speed is desirable. Referring to Fig. 4 it is obvious that if R is made a fixed resistance and a balance obtained by adjusting A and B then the original equation still holds good. Now if provision be made to move point F along A towards C, or along B towards D, the same result will be obtained. This is not possible with the ordinary bridge, because of the few available points of adjustment; but if the A and B arms are constructed with a large number of steps of small and uniform resistances, and means provided to connect point F to any one of these, then the ratio of those on one side of the point to those on the other will be the ratio of the fixed, or R, arm to the unknown resistance. In actual practice however, instead of small coils for A and B, a length of bare wire of uniform and high resistance is stretched between two points over a scale suitably divided. The method of stretching this wire in a space of convenient dimensions, and to give sufficient length, varies with different manufacturers. One method is to stretch it back and forth between two parallel rows of insulated pins and another is to wind it around a drum. In the former case the two ends of the wire correspond with points C and D of Fig. 4, and the circuit is completed with a "slider" or "tapper" taking the place of point F. With the drum method the ends of the wire are also points C and D and the drum is arranged to revolve in screw fashion, with a pitch corresponding to that of the wire winding, and making contact with a brush to take the place of the tapper. In any case the scale is divided off

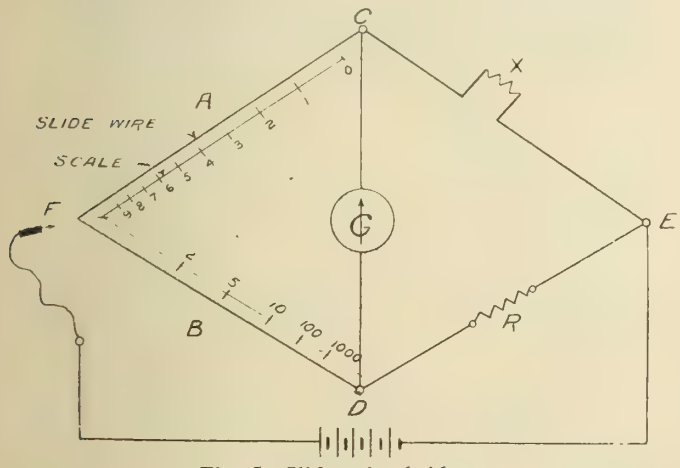


Fig. 5—Slide wire bridge.

to show the ratio between the A and B sections of the wire at any particular point.

Fig. 5 shows in conventional form the slide wire bridge, and also shows the method of dividing the scale. The fixed resistance R may be of any value, but should, if possible, be of round numbers, so that it is easily multiplied or divided by the slide wire ratio. Where a wide range of resistances have to be measured it may be in the form of an adjustable resistance, so that it can be made to coincide with the unknown resistance and more accurate results thus obtained.

A convenient range is obtained from a resistance box containing coils of 1, 10, 100 and 1000 ohms. A little study will show that when the pointer F is at the centre point of the slide wire the two parts on each side of it are equal, and the unknown resistance therefore equal to R. If a balance is obtained at a point nearer C, then the part from that point to C will bear the same relation to the remainder as the unknown does to R, that is, assuming this point to be at .1, this indicates that, when the wire is divided at this point, A is 1/10 of B, and X is 1/10 of R. Similarly if a balance is obtained on the other side of centre point, then the unknown

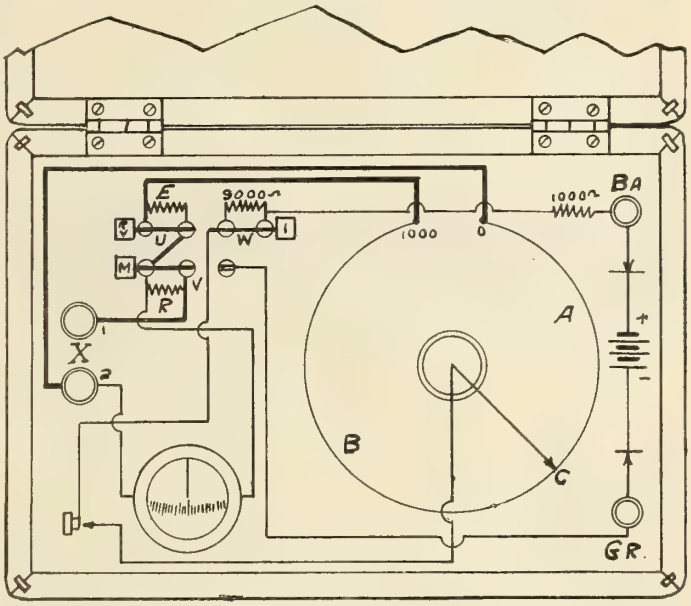


Fig. 6—Circular type slide wire bridge.

will be as much greater in proportion to R as B is to A, or if the balance point is at 2, that it is twice as great as R.

Fig. 6 shows the circuits of a well-known testing set of the slide wire type. In this instrument the usual wire is, by special construction, mounted on a ring of comparatively small diameter, and a sliding contact made to brush over the convolutions. This contact is controlled by a handle to which is attached a pointer to indicate the ratios on a circular scale; as shown on the circuit, switches are provided to easily arrange the bridge for either metallic or loop measurements and to permit the use of outside battery when necessary.

(To be continued)

* Copyright in Canada, United States and Great Britain.

1912 Telephone Extensions in Saskatchewan

Very considerable extension was made to the Saskatchewan Government system during the year ended February 28, 1912, according to a report just issued. Including the purchase of three private exchanges and cost of new construction along with the cost of maintenance and operation, there was a gross expenditure of $1,526,755.95 during the year. The gross income amounted to $392,393.17. During the year construction has been done as follows:—new toll offices 46; new exchanges 34; pole miles, long distance 516.22; wire miles, long distance, 3,766.8. Service was extended to 4,288 new subscribers during the year, making a total of 9,850 subscribers now being served. These with the 6,148 rural subscribers served by the rural systems built since the province took possession of the field makes a total of 10,534

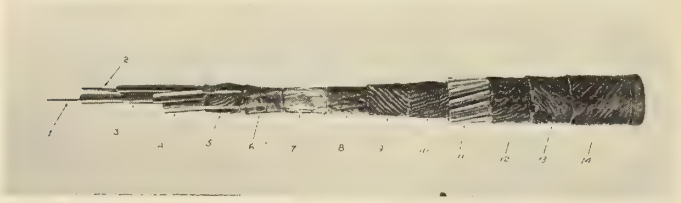
subscribers served through the provincial system. Within the year 109 companies have been organized and incorporated representing 2,140¼ miles of system serving 2,333 subscribers. This makes a total during the four years of 251 companies incorporated with 5,621¼ miles of line and 5,923 subscribers served.

The telephone situation in Saskatchewan at the above mentioned date showed 251 rural telephone companies, 22 independent companies, 5 municipal telephone systems in addition to the government system.

New Telephone Cable Across the Gulf of Georgia

A submarine telephone cable possessing several interesting features has recently been laid in the Gulf of Georgia by the British Columbia Telephone Company in connection with the development of traffic between Vancouver and Victoria and all other points on Vancouver Island.

The cable lies between Pt. Grey on the mainland, and Newcastle Island off Nanaimo, the length being 28.3 nautical miles. The shore ends terminate in cable huts where connection is made with the land lines to Vancouver and Nanaimo, these being carried on the island end by means of a special system of high poles across the narrow channel from Newcastle Island.



Section of cable stripped to show component parts.

Protection from lightning is afforded by dischargers of the Lodge Muirhead type consisting of a graduated system of spark gaps alternating with impedance coils between the land lines and the cable. The sparking points are mounted radially round the edge of a metal disc which is grounded. The apparatus is mounted in sealed iron cases, the leads entering through air-tight glands.

The cable has four conductors of the continuously loaded "Krarup" type. Each conductor consists of a central wire of pure annealed copper surrounded by twelve smaller wires, the composite conductor having a diameter of 0.139 inches and a weight of 300 pounds per nautical mile. A single soft iron wire of special manufacture, diameter 0.12, is closely and evenly wound on the conductor making 70 turns per inch. This provides for loading a continuously distributed inductance which adds so materially to the efficiency of the cable for telephone purposes.



Cable as it lay in specially constructed steel tank on board steamer that brought it from England. Tank 25 ft. in diameter. Cable 12 ft. deep in tank.

The loaded conductor is covered with three concentric coatings of best gutta percha having a total weight of 300 pounds per nautical mile. Four of these cores are stranded round a centre of yarn, the spaces between the cores being similarly fitted. A layer of brass tape is provided to prevent the possibility of teredos or other submarine borers from attacking the gutta percha. A heavy serving of tarred yarn provides a bedding for the fifteen heavy galvanized steel armoring wires each of which is separately served with tarred yarn. Two layers of prepared yarn and two coats of preservative compound complete the construction.



During cable-laying operations—nearing the end.

The cable has a diameter of nearly two inches and weighs about 8 tons per nautical mile. At a standard temperature of 75 degrees Fahrenheit the electrical constants per core per nautical mile are:—conductor resistance, 4 ohms; electrostatic capacity, 0.35 microfads; and dielectric resistance, 250 megohms after one minute electrification. The attenuation constant is about 0.019 per nautical mile of cable at a frequency of 800 cycles per second.

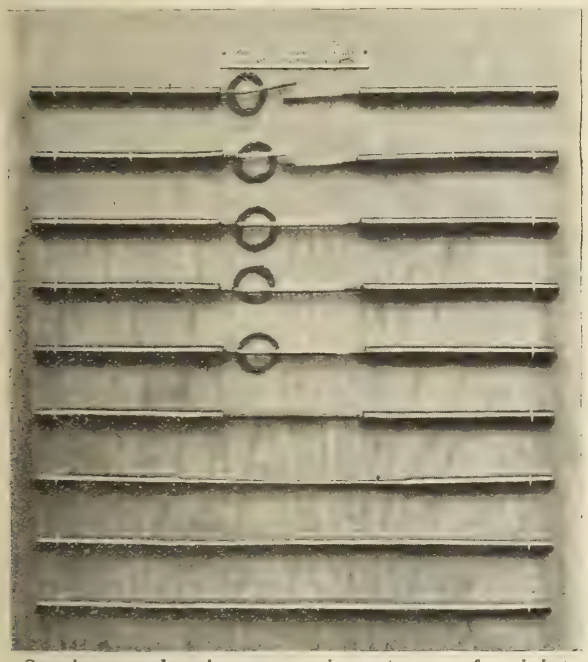
Compared with the British Standard Cable which is a pair of conductors having a resistance of 88 ohms, a mutual capacity of 0.054 microfarads and an attenuation constant of .103 per statute mile, this loaded cable is six and a quarter times as good. If compared with the American Standard Cable which has a capacity of .06 microfarads per mile the result is correspondingly better. Actual speech transmission tests taken upon completion of manufacture and also after laying give a ratio of five and a half times which is a very close confirmation when the losses by reflection and the personal errors of observation incidental to these tests are considered. The four conductors provide two highly efficient physical circuits, a third circuit being phantomed for local traffic without appreciable crosstalk.

The cable was manufactured by Henley's Telegraph Works Company of London, England, and shipped to the Pacific Coast in a sealed iron tank specially built into a freight steamer as shown in one of the accompanying photographs.

The successful laying of the cable marks an era in submarine telephony as it is laid in deeper water than any other loaded cable and is the longest of its type. The "Anglo-Belgian" Cable although considerably longer is in shallow

water and is coil-loaded, a type of construction that was not considered safe for the deep waters of the Gulf of Georgia.

A section of the telephone cable used between Vancouver Island and the mainland, stripped to show its component parts, is shown in Fig. 1. Its composition is as follows,—(1) solid copper core of the conductor; (2) composition copper conductor, including the twelve small gauge copper wires which are wrapped around No. 1; (3) what is know as the wire lapping, being a fine gauge soft iron wire continuously wound around the copper, and constituting the loading feature; (4) composition core, including the gutta percha insulation, of which there are four; (5) jute worming which is laid between the conductors to form a solid and cylindrical core of the four conductors; (6) saturated tape to bind the conductors and jute worming; (7) continuously wound brass tape to prevent teredos getting into the cores; (8) another saturated tape winding; (9 and 10) jute servings to form a



Specimens showing successive stages of a joint in the core of a continuously loaded cable, with gutta percha insulation.

cushion for the armor wires; (11) armor wires, fifteen in number, and each 3-16 of an inch in diameter, which are wound spirally; (12) jute worming which affords a cushion protection to the armor wires, and is laid between the turns of the wires; it also rounds out the form of the cable; (13 and 14) jute servings, wrapped in reverse directions to hold on the worming beneath and to complete the cylindrical form of the cable.

New Cable to Hong Kong

The first section of the new submarine telegraph cable from Europe to Hong Kong has been laid and connected with shore stations. This section is that between Colombo, Ceylon, and Penang, in the Malay States. The sections of the cable are Suez to Aden, Aden to Colombo, Colombo to Penang, Penang to Singapore, and Singapore to Hong Kong. No new section from Suez to England or the Continent is considered necessary. The next section to be undertaken is that between Penang and Singapore and the one thereafter between Singapore and Hong Kong. The last section to be laid will be the one between Aden and Colombo. This will not be undertaken until after the monsoon, the strong seasonal wind in the Indian Ocean which generally starts in June and lasts well toward September and which raises an ugly sea.

The Maritime Provinces

The Corporation of Dalhousie have started the installation of an electric power plant for supplying the town with light and power. The plant will consist of one 3-phase, 60-cycle, 75 kw., 2200 volt generator with exciter and switchboard; one series street lighting equipment; one 125 B.h.p. horizontal 2-cylinder gas engine; two 150 h.p. gas producers; also one motor driven turbine pump of 600 gals. capacity. The electrical equipment is being supplied by the Canadian General Electric Company. The engine, producers, piping and motor driven pump are being supplied by the Canadian Allis-Chalmers, Limited. Chipman and Power, Toronto, are the consulting engineers.

Grand Falls, N.B.

The Corporation of Grand Falls will shortly call for tenders covering sub-station equipment and pole line supplies for the purpose of supplying their town with a light and power service. Current will be obtained from the Maine and New Brunswick Power Company. An electric motor driven pumping plant is at present being installed in this town by the Canadian Allis-Chalmers, Limited.

Shediac, N.B.

The Corporation of Shediac are changing the method of driving their pumping plant. At present a gasoline engine is used, but instead of this there will be installed a motor driven turbine pump. Contract for this outfit together with necessary piping and valves has been awarded the Canadian Allis-Chalmers, Limited.

Halifax, N.S.

The Foundry Department of the Nova Scotia Car Company was totally destroyed by fire recently. This department will be rebuilt at once and equipped throughout with electric motor drive.

Hillis and Sons are installing an electric power plant in their foundries at Halifax. A number of motors of various sizes will be used. A noticeable feature in connection with this installation is the fact that the generator will be driven by a gas engine, the gas for same being furnished by the Halifax Tramway Company. Contract for the entire equipment has been placed with the Canadian General Electric Company.

Amherst, N.S.

The Canada Electric Company met with a serious loss during the month of June, when their auxiliary power plant in Amherst town was totally destroyed by fire. The losses include series street lighting equipment, several generators and transformers, while the steam equipment was quite badly damaged.

The Amherst Piano Company, Limited, are installing electric motor drives in their new factory. Motors will be direct connected to tools and current will be furnished by the Canada Electric Company.

Lawrencetown, N.S.

The Corporation of Lawrencetown are installing a complete lighting plant in their town. A 35 kw., 3-phase, 2200 volt generator will be used. The plant will be in operation about September 1st.

St. John, N.B.

The E. Partington Pulp and Paper Company are making a number of changes in their electrical equipment. New motors and controllers are being installed and the wiring and switchboard are being remodelled.

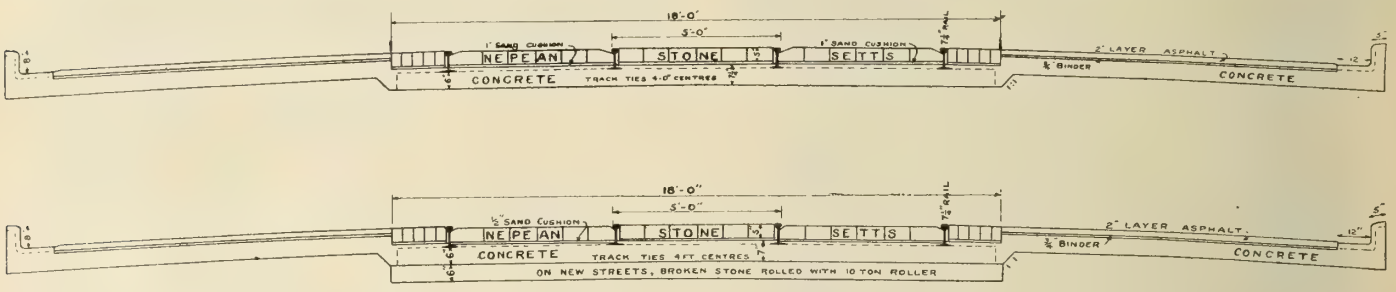
Charlottetown, P. E. I.

The Charlottetown Light & Power Company are making a number of changes in their power plant. A second gas producer and engine is being installed also a quantity of electrical machinery. The frequency of the present plant is 133-cycles, but the new equipment will be 60-cycles. When the changes are completed a day service will be started.

Electric Railways

Track Construction in Hull, Que.

The two accompanying drawings are illustrative of the paving construction work of the Hull Electric Company, the upper representing the roadway at present in use and the lower figure the type of construction this company proposes adopting for future work. The Hull Electric operate both city and interurban lines but the interurban track construction does not vary from standard steam traction. They have about one mile of paved double-track street and it is proposed to pave another mile during the coming summer. It will be noted that Nepean sandstone blocks are used for paving. In order to make a flangeway with Nepean sandstone blocks, the corners of the blocks are chipped off. This makes a very uneven flange-way which tends to become filled with mud in the summer and ice in the winter. The plan will, therefore, be followed in future of lowering the blocks three-quarters of an inch below the head of the rails so that the size of the cutoff of the corner of the blocks is much reduced, also during the winter a coating of one-half to three-quarters of an inch of hard ice or snow provides a good roadway. During the summer there is also less danger to vehicle traffic as wheels can bind only on one side of the track—the other side being practically clear. The advantage of having the blocks crowned between the rails, or level with the rails at the same height, is not very great and there is the disadvantage that during the winter this portion of the roadway is swept clean by the snow sweepers.



Mr. G. Gordon Gale is general superintendent of the Hull Electric Company.

Gas-Electric Cars

The London (Eng.) County Council have recently placed in operation some three miles of line on which the cars are operated by gas-electric equipment. The decision to use this type of car resulted from objection to the trolley system and the prohibitive cost of the alternative conduit system.

A 40 horse-power gasoline engine together with motors, generator, controllers, etc., were manufactured by the W. A. Stevens, Limited, at their Maidstone works. There are two motors, 20 horse-power each, one for each axle and geared to the axle by a 6 to 1 reduction. Either of the motors is capable of operating the car on the level road. The generator is of the shunt-wound, inter-pole type, 350 volts. The engine operates at 700 to 1000 r.p.m.

Arrangements have been made in the wiring construction by which it is possible to operate the motors from either an overhead or a conduit supply as an alternative to the contained generator, so that the cars can be operated either as purely electric or as gas-electric.

The cars are double-deck, 27 ft. in length over all. The engine is placed on the front platform and the generator just to the rear of the engine and extending up under the front end of one of the longitudinal seats.

It is reported that the experiment promises to be very successful and that in all probability the three original trial cars will be supplemented by others.

"One-Man" Cars

The Sherbrooke Railway & Power Company have been operating in Sherbrooke some "one-man" cars. These cars were not specially built but were made from rolling stock in hand and have been found very satisfactory. Changing over the open cars was a little more difficult than the closed cars. On each side of the open cars a wire guard of 1¼ in. sq. mesh, No. 10 wire, was placed. One entrance and exit was left on each end of the car and a door way was cut in each bulk head. Being a double ended car it was necessary to



Sherbrooke one-man cars.

provide a folding gate at each end and also a folding step. On reaching the terminus the rear gate is closed and locked so that passengers both board and alight from the car at the front end. With these cars the stops are made on the near side of the streets.

The seating arrangements were altered to make room for an aisle from the bulkhead entrance to the centre of the car. This reduced the seating capacity somewhat but as these cars are seldom crowded on the lines on which they are operated the reduced seating capacity is not important. Standing room was, of course, increased.

These cars have been the means of reducing platform expense considerably and there has been no accident of any kind to date. The schedule speed on these lines is 8 miles per hour which the one-man cars have been able to maintain.

A New Trolley Catcher

The Ohio Brass Company are now offering for sale the new trolley catcher shown in the accompanying illustrations. Fig. 2 shows the principal parts of the operating mechanism. Three dogs, mounted on the back of the reel are thrown outward by centrifugal force when the trolley wheel jumps. One dog rides over the guide, A-B, and engages the stop at B. Under normal conditions, these dogs are held in toward the centre by rugged coiled springs which are enamelled to prevent rusting. In operation the coiled springs are only slightly extended, insuring long life. The main operating spring is enclosed in the extreme back part of the case. All parts are made sufficiently rugged to withstand the abuse which such a device usually gets in service. The case is made of malleable iron, enamelled. A large opening is provided at the bottom to drain off moisture. A separate base casting is bolted directly to the car dash and the catcher can be quickly inserted in the base and held in place by a

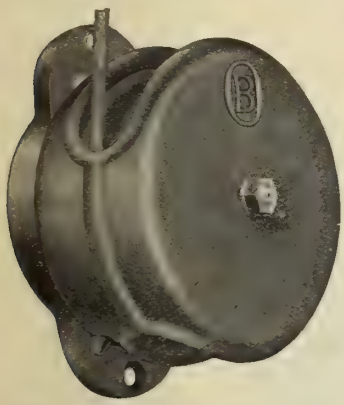


Fig. 1—O-B Trolley Catcher



Fig. 2—Pantom View

spring operated catch. For double end operation, a base is installed on each end of the car and one catcher used.

One of the aims of the designers was to eliminate stepping up or climbing of the trolley pole after the rebound which follows the sudden stopping of a flying pole. This was accomplished by means of the guide, A-B, Fig. 2. The dog which engages the stop at B rides over this guide and cannot be pulled back toward the centre by its spring until the rope has been wound in sufficiently to allow the dog to travel backward on the guide to the point A. Exhaustive service tests proved that the rebound will never be sufficient to cause this to happen. In other words, when the trolley wheel jumps, the catcher catches the pole quickly and holds it when caught. Should the trolley pole be thrown downward upon striking a cross span wire the locking dog will become disengaged and the catcher will "reoperate" and another dog will become engaged with stop B, and the pole will then be held at approximately the lowest point to which it rebounds. The manufacturers offer to furnish samples of the new catcher to proper parties for free service demonstration.

Train Operation in City Service

The Public Service Railway Commission of New Jersey has recently been conducting a series of tests for the purpose of determining whether the operation of two-car trains in city service is practicable or desirable and the results have been published. In Newark, where the tests were made, rush hour traffic becomes so conjested as to prevent the operation of a sufficient number of cars to meet the requirements. The cars used were 46 ft. 4 in. in length with seating capacity of 44 and a total weight of 48,700 lbs. each. Each car was equipped with four motors and were of the double-end prepayment type equipped with hand operated doors on all platforms.

Comparative tests were made for a number of lines with single cars, two-car units, and a motor with trailer. The results in general go to show that the two-car train can be operated throughout the route on the same schedule as the single cars and much more satisfactorily than the motor and trailer.

At conjested corners an observation showed, as an example, that two single cars crossing one after the other required on the average 27.1 seconds, as compared with 20 seconds for the train to pass the same corner.

Commenting on the results obtained in these tests the Electric Railway Journal, having made a careful study of the report, has this to say:—

"The results show that, aside from any question of operating cost, the use of trains is entirely practicable in congested city service such as obtains in Newark. That is to say, the tests demonstrated that the riding public accepted the arrangement at once without objection, and no difficulties were experienced through interference of the long two-car units with vehicular traffic. The observations as taken indicate that the train carrying a large number of passengers makes a greater number of stops per trip than a single car. For a given total number of passengers the number of stops is practically the same whether the load is carried by one car or two. This might be expected, as people will board and alight at the same points regardless of the method by which they are transported. The rate of increase in the number of stops is, however, by no means directly proportional to the number of passengers. Instead, it falls off rapidly as the loads become heavy. In other words the number of stops per trip tends to become constant or independent of the number of passengers provided the total number carried is sufficiently great. On none of the test lines in Newark is this point reached within the capacity of the two-car train, but the tendency was so strongly marked when both cars of the train were comfortably filled that the train made only about one more stop per mile than each car would have made had they been run singly.

The loading time per passenger will be found to be approximately the same on the train and on the single car, indicating that the time lost through the transmission of bell signals, through the unequal distribution of passengers between the two cars and through the necessity for the single exit of the rear car was just about offset by the fact that the train provided two entrances for the total number of passengers boarding as against the single entrance of the single car.

It is, however, a fact except on two of the lines tested, that both the public and train crews were unfamiliar with train operation. This, it is believed, influenced adversely the running time of the trains as compared with single cars.

Based upon equivalent passenger loads the observations show that the use of trailers causes a serious slowing down of schedule speeds—much more than enough, in fact, to offset the inherent savings. This is undoubtedly due to the fact that the four 40-50-h.p. motors geared 18:66 were not sufficient to haul a trailer weighing 32,800 lbs. when both cars in the train were heavily loaded."

Illumination

Combination Trolley and Light Poles

The illustrations herewith represent types of combination trolley and electric light poles recently supplied by the Electric Railway Equipment Company. The single light pole is in use in Edmonton and the double light type is now being installed in the city of Niagara Falls.

Both single and double type brackets have met with approval, on account of provision having been made in the body of the bracket for mounting positive cut-out in same. In



Combination trolley and electric light poles.

placing cut-out at this point it is not necessary to slot tubular pole at groundline, which has a tendency to weaken the pole at point of greatest strain. In order that cut-out could be operated quickly and without the necessity of using a ladder to reach it, a small chain attached to the cut-out has been provided. By using a small hooked rod, the operator can stand on the sidewalk and cut lamp in or out of circuit. The chain is carefully insulated from all current carrying parts and there is no possibility of leakage at this point.

The Niagara Falls order consists of 112 trolley poles which will be placed 70 ft. apart and two lights mounted on each.

The type of lamp used on all these poles is the General Electric magnetite arc. These will be placed, in the Niagara Falls installation, so that one extends over the roadway and the other over the sidewalk.

Large Areas and Exterior Illumination

There is no doubt that the tungsten lamp since its advent has affected to a certain extent the sale of enclosed arc lamps. At the same time there are numerous cases where conditions require an intensely brilliant light over a large area and there the enclosed arc is ideal. Such conditions are frequently found in car shops, locomotive works, foundries, cement works, glass factories, freight yards, wharf lighting, etc. The flame arc lamp is particularly adaptable for this class of service and among the recent developments of this class of lamp, attention is drawn to the C.G.E. type "W," flame arc lamp, shown in the accompanying cut.

Until recently the chief characteristic of the various types of flame lamps seen on the market was, in most cases, length



C.G.E. flame lamp.

in inches rather than length of life. A notable departure has been made in the C.G.E. type "W" flame lamp, inasmuch, as the length over all is only 32 inches. The life per trim is 100 to 120 hours, and then the only thing required is the renewing of one electrode. This last speaks well on the question of maintenance. The mechanism follows closely the general design of the standard enclosed carbon arc lamp,

which makes the lamp easy to operate and avoids a multiplicity of parts. The type "W" lamps are furnished in either a.c. or d.c. multiple, also a.c. series.

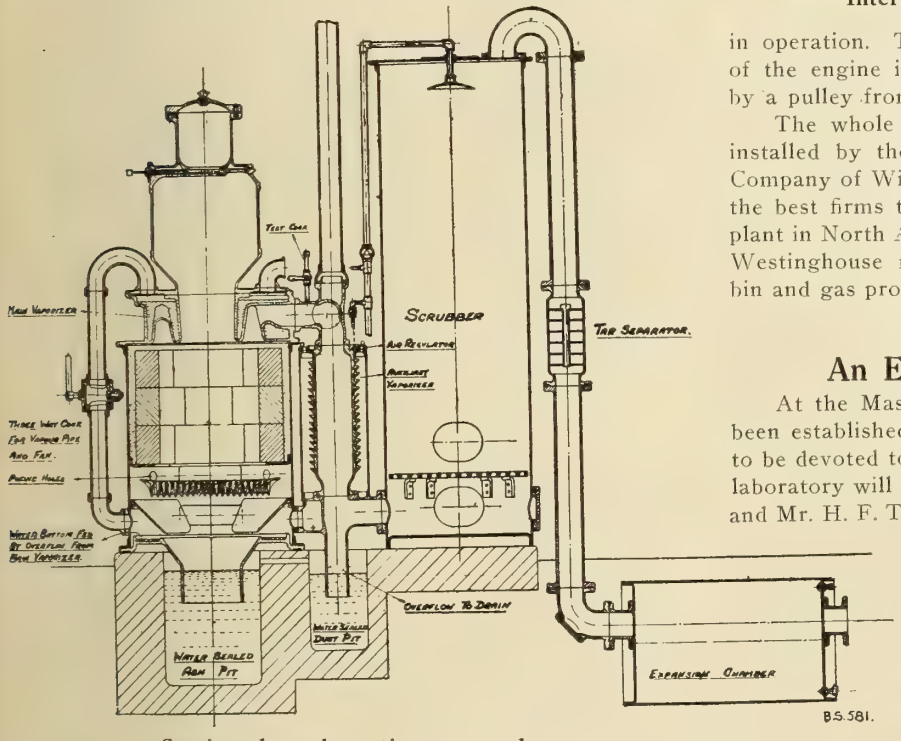
Rapid City Electric Light Plant

By Mr. Thomas Town*

The electric light plant at Rapid City, Man., which was set in operation on the fourth of March, 1913, has proved itself to be of great benefit to the town. Many of the public buildings that had lately been fitted with some of the best gasoline systems have had them replaced by electric light and the gasoline street lamps which have only been in use a short time have been replaced by forty 100 watt tungsten lamps, which have made a vast improvement in the appearance and the lighting of the town. The photo reproduced herewith shows the entire engine-room. The engine is a 50 B.h.p. gas-engine of the throttle governing type which furnishes the power to generate the electricity.

The current is sold at the rate of 20 cents per kw. hour with a minimum charge of $1 per month. The generator is a 3-phase, thirty kw., sixty cycle, 2300 volt unit. This generator is belted to a Ruston-Proctor suction gas engine, which is fed with coal gas supplied by the producer shown in diagram herewith. The cross-section explains the process by which the engine is fed with gas from the producer. The gas passes up through the coal in the producer, in through a coke scrubber, up through this, where the gas is cooled by the water passing through the filtrate, and is also purified; then into an expansion tank and from thence to the cylinder of the engine.

The gas-producer after being filled up with coal will run

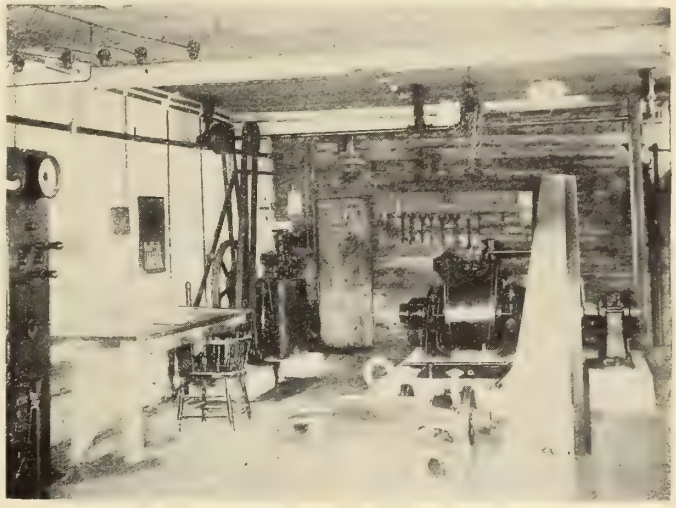


Section through suction gas producer.

from four to six hours without attention. The consumption of coal is at the rate of ¾ lbs. per horse-power, per hour, at full load. The cost of running the plant for 10 hours, with coal at $8 per ton, and oil at 70 cts. per gallon, amounts to $1.14. The results given below are those made by the writer on a ten-hour test, running at half load (15 kw.).

Coal consumption, 250 lbs.	$1.00
Cylinder oil, at 70 cts. per gal., 1 pt.	.09
Ordinary lub. oil, at 30 cts. per gal., 1¼ pt. ...	.05
Total	$1.14

From fifteen to twenty minutes is taken in starting the engine. The producer is first made to work freely by the use of a hand blower, then the air of 160 lbs. to the square inch from the compressed air tank is let into the cylinder causing it to start the operation of the engine and keep it going until the engine begins to draw gas from the producer, which if air is shut off will fill the cylinder at each stroke and fire, the same as in any ordinary gas engine. The fire in the producer is kept burning by the suction of the engine after it is set



Interior power house, Rapid City, Man.

in operation. The compressed air required for the starting of the engine is pumped into the tank directly on starting by a pulley from the engine.

The whole plant including the electrical apparatus was installed by the British Canadian Engineering and Supply Company of Winnipeg. This company promises to be one of the best firms to install an effectual and economical electric plant in North America. The electrical equipments are of the Westinghouse make. The whole plant, including the coal bin and gas producing room, occupies a space of 15 x 56 ft.

*Resident Engineer, Rapid City.

An Electrical Research Laboratory

At the Massachusetts Institute of Technology there has been established an Electrical Research Laboratory which is to be devoted to research and engineering investigation. The laboratory will be in charge of Dr. Harold Pender as director and Mr. H. F. Thomson as secretary and assistant to the director. Large sums of money have been donated for the up-keep of the laboratory, among the many liberal donors being the American Telephone and Telegraph Company. The problems which it is proposed to take up during the present summer have reference to the clearness of speech as heard through the telephone and to the transmission of alternating current in wires. The first will be an investigation of the effect of phase relation of harmonics in sound waves while the second will be a study of "skin effect" a phenomenon which causes a greater resistance of conductors in alternating than in direct current.

The laboratory will be open the year round and will be in charge at all times of men specially trained in research work. It is the intention to conduct the laboratory entirely along business principles.

The Dealer and Contractor

Costs and Efficiency

By Mr. P. L Proctor*

The subject I have taken for my address is one which you are more or less familiar with, but it is my purpose to explain to you details from an accountant's view. In the time at my disposal, however, I am constrained to limit my views to a lucid summarized explanation of the principles involved, and to eliminate elaboration, which would tend to confuse, and therefore defeat my purpose. I shall endeavor also to confine my theories so as to make them applicable specifically to the needs of the electrical contractor, instead of speaking in generalities. It is well to forget, however, at this time that "the electrical contractor's business is different," and for those who might have the tendency to follow the lines of least resistance, I will say that the principles of costs and efficiency remain unchanged, no matter to what business they are applied. The details change, but the principles remain the same.

The principles of costs as related to the electrical contractor, or any other contractor, are: Material, time, direct expense, and indirect expense. The total of these, plus profit, is the amount a contractor must estimate in order to assure himself of his legitimate profit.

In order to arrive at a complete understanding of one's business, one must introduce a scheme of accounts for ascertaining and recording the cost of production; locate all weak places and so detect waste of material, efficient workmanship and management: indicate the expediency of underbidding a competitor by comparing the cost of production with his bid; establish a standard cost on certain jobs; expedite the framing of estimates to prevent loss by making low quotations or unnecessary high ones, which will permit a competitor to underbid; regulate bidding price according to cost when conditions of supply and demand permit. These features must necessarily be embraced in one's cost system in order that it should be beneficial.

Now let us examine such a scheme to see in what way it would benefit you:

1. Where external conditions permit you will be able to adjust bidding price on the basis of costs.

Many a business man, or, I should say, self-styled business man, especially a debutant, feels that he is ruining his business by not grasping every job that comes along. He never stops to consider where his profit is going to be realized, but the sight of a few dollars, or the anticipation, goes to his head. Business conducted in this manner results in the inevitable transfer to the "has-been" list. The unbusinesslike principles of this one man do not only affect him as an individual, but they affect the whole trade as a body. Profit can be made on all work, but if one contractor makes a practice of underbidding, the consequences are that other contractors must patiently wait until the bankruptcy law begins to stretch out its arms for him. If "John Smith" makes an estimate on a job which you know you cannot compete with, you had better let him take it. Either he will go out of business, or your own business needs rigid investigation.

2. It automatically locates weak places and points out excessive cost.

A feature which is indispensable. There are weak places in every business, and the only way to eliminate these weak points is by first assuring yourself in what department they prevail and in what unit of that department.

3. It furnishes a basis of comparing costs of various elements at different periods of time, indicating excessive increase of cost or decrease in output.

Knowledge of one's business is attained by comparison. The fact that one has lost money on an estimate, but made money on a prior duplicate of it, is sufficient grounds for an investigation. The investigation must be a comparative one. The material used on the subsequent estimate may have been more expensive, the labor employed may not be as efficient, the management may be at fault, but by the introduction of a comparative cost scheme these elements would be obvious before an estimate is made and not when it is too late.

4. Shows the exact point where attention should be focused.

5. Where external conditions fix estimates you will know exact cost of production and be able to secure advantageous contracts which may otherwise go to a competitor.

It is often necessary for a contractor to reduce his estimate down to the minimum on account of external conditions over which he has no control. It is also necessary—or is considered business policy—for a contractor to reduce his estimate practically to cost of production in order to become acquainted with various architects with the idea that it may in some future time secure for him advantageous contracts. It is essential at such a time for him to know where the line of danger lies, and to know definitely his cost of production.

6. It determines the earning capacity of individuals, departments, branches, or entire organization.

By the old methods of accounting it was possible only to determine at stock taking the amount of profit or loss of the entire organization. Competition makes it necessary for the business man of to-day to go further than this. The public designates the price for a certain class of work, and this has forced the business man to look elsewhere for profit. The only available place is the cost of production. It is essential then that he know the relative earning capacity of his men as individuals or the departments of his business.

7. It indicates the expediency of underbidding any competitor.

I have before mentioned that the contractor must know where to draw the line in underbidding, and not rush headlong into any contract. Money has strong hypnotic powers, and unless a business man uses his discretion, he is gradually drawn in to the maelstrom of failure by it. A man who has no system to his business usually is also devoid of discretion.

8. It furnishes a basis of protection from undue expense or loss from any source.

This is again brought about by comparison. "Undue expense" may be inefficiency in workmen, careless work,

* Manager the Pacific Audit Company.

which necessitates its being done over again. This may be traced to the foreman, who has urged too much speed. This may again be traced to the executive who has given such instructions to the foreman. Low estimates often make it necessary for an executive to urge his men to better speed in order to avert a loss which he alone is responsible for. It will be seen that it is possible to trace the trouble to its foundation, therefore overcoming the most difficult obstacle in the way of eliminating it.

9. It shows how and when to reduce unnecessary fixed charges, such as time, material, men, records, interruptions, overtime, handling etc.

In order to facilitate arriving at the costs of any job particular attention should be paid to the manner of recording estimates. An estimate should be divided into departments in exactly the same manner that the cost records record the progress of a job by departments. Each job should have its various departments, as follows:

Floor No. 1—

Wire, plus time, plus direct expense, plus indirect expense equals cost of wiring floor No. 1.

Pipe, plus time, plus direct expense, plus indirect expense equals cost of piping floor No. 1.

It will be readily seen that were estimates to be kept on file in this detailed manner, and the cost records kept to conform to it, the executive would soon locate his weak points in making estimates, and by careful examination of each day's work he would readily see whether or not the estimate in any particular unit and the profits anticipated on it were going to be realized. You will readily agree with me, I think, that such information is valuable, for it gives a reliable basis of argument should the contractor find it necessary to urge his men to "speed up" in order to break even on any particular unit of the work.

The distribution of indirect expense or burden has become the subject of much discussion and debate by many cost experts. Many theories have been advanced from time to time by some of our leading production engineers and cost accountants as to the distribution of indirect expense, but it is as much open to discussion at the present time as it ever was.

At this time we are only interested in the method that best fits the requirements of the contractor, and after much thought I have come to the conclusion that the distribution of burden by the time plan is the one that is more adaptable to his needs. A summarized explanation of this method is: That every productive man in the employ of a company must bear his pro rata of indirect expense of that company. We will take an hypothetical instance:

A Typical Case

You are called upon to make an estimate on a job. Your overhead expense or burden amounts to $12 per day. There are 12 productive men in your employ, therefore each man will bear $1 overhead expense per day. Your estimate will read as follows:

Material	$25.00
Time, 1 man 1½ days at $4.00 per day	6.00
Overhead expense, 1 man 1½ days at $1.00 per day	1.50
Cost of production	32.50
Profit, 25 per cent.	8.12
Amount of estimate	40.62

You will see by this method that the overhead expense practically adjusts itself automatically to a fair amount per productive man. A large increase in productive men generally means a proportionate increase in unproductive men, and, on the other hand, a reduction in the productive force means a proportionate reduction in the unproductive force. At the same time there are certain fixed charges that a reduction in the productive force would not affect, such as rent, light, heat, office expense, etc., and in this case the executive must use due discretion, and must by careful examination ascertain where he can reduce his overhead cost, so as to bring it down to a standard whereby he can render satisfactory estimates and still assure himself of profit.

A cost system which comprises the information I have just referred to is the first step toward efficient management.

To build up a successful business one must not only know the trade or profession in which he has started, but he must be prepared to meet his competitors and start on a level which it has taken them years to attain. In order to do this he must not only familiarize himself with the principles of costs, but he must, each day, watch his business with an eye which has keen analytic powers. Business is a living, breathing, moving being which has an anatomy peculiar to itself, but which can nevertheless be analyzed in its every function. It is the duty of a manager of any business to grasp and interpret his business conditions by units.

I am sorry to say that bookkeeping is only tolerated by many men. It is charged up as a loss and the expression, "if I could only cut down my office force," crude as it may seem to many of us, is by no means uncommon. This class reminds me of an Egyptian mummy. A mummy's only asset is its age, and the only emotion it inspires is one of wonderment that it has lasted.

I will tell you that 75 per cent. of business failures were mummified businesses. If they had been galvanized into new life before it was too late they would be still doing business on a sound basis.

Records Are Invaluable

I have remarked that account keeping was only tolerated and I will venture to say that 50 per cent. of the business men in this country do not use their records enough to become acquainted with the invaluable information they possess. Account keeping, for prudence sake, is worse than no account keeping, for the man who keeps no accounts obtains the same information, which is nil, as the man who keeps accounts for prudence sake, and at less cost. If you are going to keep accounts and are employing an office force to keep them for you, do not let this department become a loss to your business. If it be used in the manner for which is was intended, namely, to give reliable facts of business transactions, it would become one of the most profitable departments in your organization.

Another principle which is absorbing the minds of our eminent business men is the relationship which should exist between employer and employee. A contractor's profits rest in the efficiency of his workmen, therefore it should be the contractor's foremost thought. There is a lot of unnecessary dignity which is impressed upon the mind of the employee by the employer. This has an unwholesome tendency to widen a breach which is already dangerous between these two classes. Capital makes labor and labor makes capital, therefore, the two existing because of this relationship should be brought together in practical harmony. An employer should learn to understand his men and acquaint himself with their efficiencies and inefficiencies. Hiring and firing are indiscriminately practised without study and discretion. All business men have different ideas of conducting their business, and when an employee has been in one man's service a little while he becomes a capital investment and not as a movable commodity. There are many ways by which an employee can be interested not only in the work which he is employed to do, but in the company at large; for it is the organization which has the cooperation of all its employees that, undisturbed by turbulent feelings of its workers which in so many cases is the ruin of many, forges steadily ahead and pays dividends on an inexpensive investment of courtesy.

In closing I would urge the electrical contractors of this country to draft up a cost system, which will be applicable to your needs, and which can be cut down or elaborated on to suit the business of every contractor, be it large or small.

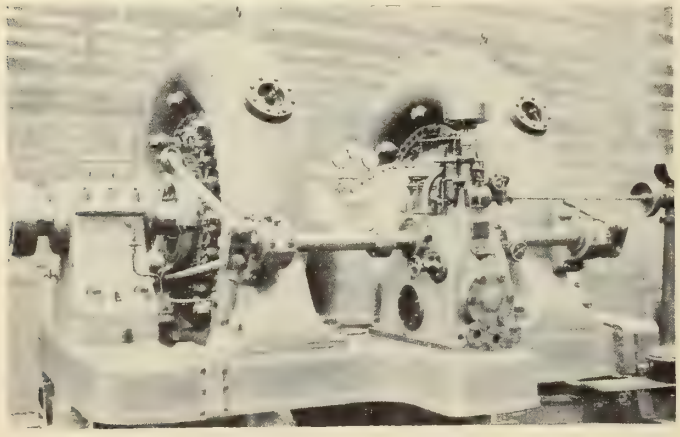
An Electrified Yellow Peril

The unparalled industrial boom Japan experienced during the last few years has brought with it an enormous increase in the demand for cheap electrical energy throughout the country and particularly in the city of Tokyo. In 1908 the Tokyo Electric Light Company completed their hydro-electric power station on the Katsura River about 100 miles from Tokyo, at this time the largest and most important power station in Japan. The total output of this plant was 27,500 h.p. developed by six Escher Wyss Francis turbines direct coupled to generators of Siemens make. One year later the company had sold the whole of the energy developed and a second plant of increased capacity had to be taken in hand. It was decided to develop a fall ten miles down stream on the same river, where 42,000 continuous horse-power could be obtained. The minimum flow of the river was measured to be 850 cubic feet per second, while the net head available varied from 368 ft. to 396 ft. maximum. By providing a reservoir of sufficient storage capacity the plant could deal with a peak load of 50,000 h.p.

The contract for the complete hydraulic installation was again let to Escher Wyss & Company, Zurich, comprising six main turbines of 12,500 h.p., including the oil pressure plant as well as the distributing piping with the necessary gate valves. With a total capacity of 75,000 h.p. not including the power required by the auxiliaries, this new installation is again the greatest power plant in Japan.

Regarding the lay-out of the plant the following may be briefly mentioned:—

The water is brought through a tunnel to the forebay and from there in six parallel pipelines of 700 ft. length and 6 ft. diameter to the turbines. Each turbine has its own pipeline, the exciter turbines being fed by a seventh pipe of smaller diameter. The main turbines are arranged in two groups, each consisting of three units, one group on each side of the switchboard. The distributing pipes and valves are on the lower floor, thus leaving the engine room proper free and allowing for easy access and attendance. For the transformers and connections a second building is provided.



Francis type turbines for Tokyo, Japan.

The pipeline for each main turbine is connected by means of a conical pipe to a gate valve of 4 ft. 7 in. diameter operated hydraulicly by pressure water taken from the penstock. A cast steel Y piece and bend connect the turbines to the main gate valves.

The main turbines are Francis, twin spiral type with horizontal shaft running at 375 r.p.m. and are coupled direct to the alternators, the coupling flanges being forged on to the shaft. Each unit is mounted on a solid cast iron base plate grouted into the engine room floor. This arrangement ensures a very accurate and simple lining up on site, easy dismantling and remounting for repairs, and equal pressure on the foundations. The shaft runs in two ring lubricated bearings of ample dimensions mounted on pedestals. The bearing on the free end is fitted with thrust collars. The lower bushings of both bearings are hollow and water cooled. The runners are made in special bronze and screwed on to flanges forged on to the shaft. The spiral casings are made in cast iron reinforced by steel bolts and guide ribs cast in. The guide apparatus is arranged outside the turbine casing, thus making all links and bolts accessible. The guide rings and covers in contact with the water have cast steel linings, which are easily interchangeable in case of wear. To reduce the distance between the bearings the draft chest has an elliptical form on the bottom. An intermediate pipe connects this draft chest to the wrought iron draft tubes.

The turbines are regulated automatically by oil pressure governors of Escher Wyss patent, mounted on the same bedplate as the turbine. The governor is the largest size of Escher Wyss standard type, fitted with speed changing device from the switchboard and with quick closing device in case of falling off of belt, thus preventing the running away of the set. The servo-motor can be operated by hand instead of automatically, by means of a hand wheel regulating the access of the oil pressure to the one or the other side of the cylinder. The necessary pressure oil for the governors is supplied by an oil pressure plant.

To prevent dangerous pressure shocks in the pipeline under sudden throwing off of load of the turbines a relief valve is provided for operating direct from the governing gearing of the turbine. The relief valve works in such a way that when the governor closes the guide vanes to a certain amount the corresponding area is opened in the relief valve. To prevent losses in water the relief valve closes automatically after a certain time.

The exciter turbines of 460 h.p. are coupled by means of flexible couplings to the exciters running at 600 r.p.m. The turbines are impulse wheels with two nozzles, each regulated by an oil pressure governor mounted on top of the casing. The oil pressure plant consists of three pump groups, each group of sufficient size to feed 4 generator turbines and governors. Each pump is driven by a small impulse wheel of about 25 h.p. running at 80-100 r.p.m. Regulation is done by hand by throttling the pressure in the needle nozzle. All parts exposed to water pressure were tested at 350 lbs. per square inch. The installation is working since October, 1912, and, according to a statement made by the company, has been a great success in every respect.

Low Voltage Transformers

To meet the demand for a small low priced transformer of guaranteed efficiency which will operate small electric trains, motors and other toys. The Thordarson Manufacturing Company, of 508 South Jefferson Street, Chicago, have recently placed on the market a new toy transformer.

In this new unit, the secondary is equipped with three taps generating three, six and nine volts. As with the other transformers manufactured by this company, every care has been taken to render this transformer indestructible. It is enclosed in a steel case and immersed in an insulating compound that makes it impervious to moisture. Each transformer is equipped with a plug and a supply of flexible cord so that it may be attached to any alternating current lamp socket.

These transformers are extremely popular with the boys. They are really a miniature power plant and the uses to which they may be put are limited only by the ingenuity of the experimenter. The larger size transformers, which have proven so popular in former years, will also be carried. They furnish current from three to twenty-six volts and three to nineteen volts.

New Line of Veeder Counters

The accompanying illustrations show a new line of counters recently brought out by the Veeder Mfg. Company of Hartford, Conn. These are in two styles termed respectively "Setback" and "Locked Wheel" counters. Fig. 1 shows the four-wheel Setback counter suitable for use in counting separate lots of work on punch presses, printing presses, looms, stamping machines, etc. Fig. 2 shows the Locked Wheel counter similar to Fig. 1. In the design of these new counters special care has been taken in making an instrument that will operate with the greatest ease. Each wheel turns upon a comparatively small shaft and the pinion which transfers the motion from one wheel to the other also turns on small shafts. The counter is built up of units, each unit consisting of a short section or shell which carries a pinion and entirely encloses the number wheel with the exception of an opening through which the figures are read. This enables the manufacturer to furnish as many number wheels as may be desired within certain limits. The usual number supplied is four, but the counter may be supplied

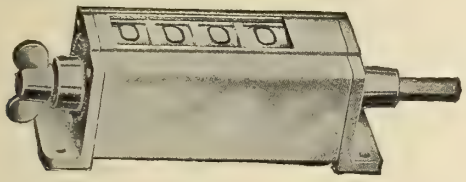


Fig. 1.

with only two or with six or eight sections. Both styles of counters are furnished with the following forms of driving mechanism:

(1) The rotary ratchet, which drives the right-hand wheel forward by an oscillating motion of the lever on the driving shaft. The driving shaft may be rotated through any number of degrees, or even revolved continuously in either direction. If driven forward, it will count ten for each revolution; if driven backward the number wheel will not be moved. An oscillating movement of from 40 to 60 degrees will count one figure at each movement.

(2) The direct drive,—in this arrangement the driving shaft is directly connected to the first or right-hand wheel and one revolution of the driving shaft will count ten. If the shaft of the Locked Wheel Direct Drive Counter is run backwards the number will be subtracted.



Fig. 2.

(3) The revolution counter,—in this mechanism the right-hand wheel is driven by a gear, which is mounted on an eccentric on the driving shaft, but is prevented from turning by a short oscillation link. It counts one figure for every revolution of the shaft.

The driving shaft in all of these counters, as customarily furnished, runs on plain bearings, but where they are desired for continuous running, they may be supplied with ball bearings. The number wheels have large figures and wide faces, so that the counter can be very easily read. There are no exposed gears which would tend to make it difficult to read the figures. The figures on the counters are ¼ inch high and can be easily read at a distance of ten feet. Each unit is ½ inch wide.

R. E. T. Pringle Specialties

The illustrations of lamps shown herewith are the latest productions of the Adams Bagnall Electric Company for the electric lighting of automobiles. They are characterized by the three features of greater illumination efficiency, unique construction features, and a reasonable price. These units are made in a factory said to have the largest punch press and spinning lathe equipment in the country devoted to the production of light-reflecting devices. The reflectors themselves are made by a combination punch press and spinning



Fig. 1.



Fig. 2



Fig. 3.

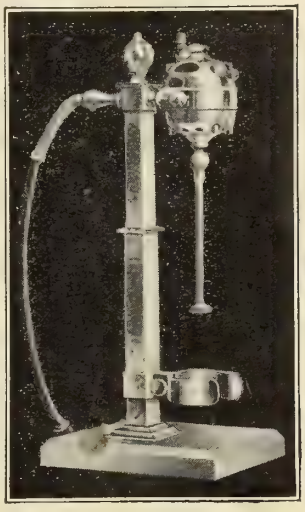


Fig. 4.

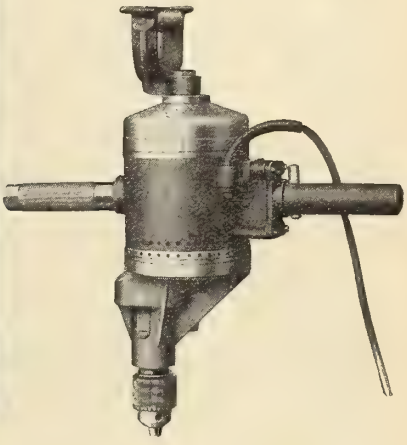


Fig. 5.

process worked out to produce the best surface upon which to apply a finish. The silver is heavily applied to the prepared brass background by electroplating which insures durability and efficiency throughout the life of the reflector. Figs. 1, 2 and 3 show types of this lamp; Fig. 4 is a new silver-plated, electrically operated, Cyclone mixer. Fig. 5 represents a new type 3/8-inch, universal Van Dorn & Dutton Electric drill. R. E. T. Pringle holds the agency for the above products.

The Keystone Traveller

The Keystone Traveller for July, 1913, issued by the Electric Service Supplies Company, Philadelphia, Pa., contains much interesting information regarding their products. The chapter on prepayment cars contains statistics compiled by the Detroit United Railways Company, showing the great decrease in accidents due entirely to their installation of prepayment cars. A very interesting letter is reprinted in connection with the chapter on automotoneers, which states that one of these devices played a very important part in a damage claim proceedings and resulted in the plaintiff's $25,000 claim being decided in favor of the operating company. Many other interesting discussions about Keystone steel gear cases, Garton-Daniels lightning arresters, automatic trolley guard, etc., will make it of interest to operating men.

Micarta

A new material known as "Micarta" designed to take the place of hard fibre, glass, hard rubber, built-up mica, press board, raw hide, moulded compounds, etc., has been developed by the Westinghouse Electric & Mfg. Company. It is used for commutator bushings and brush holder insulation, for noiseless gear blanks, as conduit for automobile wiring, as spools for spark coil and magnet windings, for refillable fuse tubes, for wireless coil separators, for arc shields in circuit breakers, for water meter discs, etc., etc. Micarta is



Fig. 1—Accidental fracture of a 6-in. Micarta tube.

of a tan brown color and is a hard homogeneous material, having mechanical strength about fifty per cent. greater than hard fibre. As proof of its uniformity of structure the accompanying illustration of a fracture produced under pressure, is shown. The tube was held tight on a metal mandrel and a compressive force was applied at one end of the tube. When the force became sufficiently great the tube split, as shown. Such a break is known as a "harmonic" fracture. The strains in a homogeneous material under stress follow a sine wave law and the photograph shows how truly homogeneous this material must have been.

Micarta can readily be sawed, milled, turned, tapped, or threaded. It is not brittle and will not warp, expand or shrink with age or exposure to the weather. There are two grades, one of which will stand a temperature of 150 deg. C. continuously or 250 deg. C. for a short period of time. It

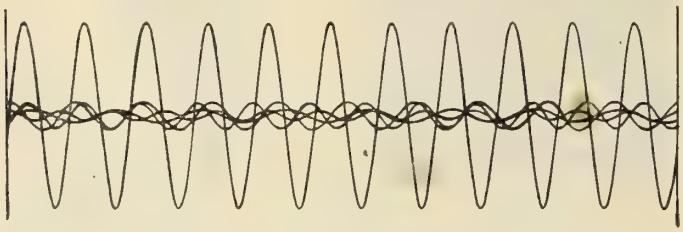


Fig. 2—Harmonic analysis of fracture wave in Fig. 1.

is infusible and will stand an electric arc better than hard fibre, hard rubber, built-up mica or any moulded insulation containing fibrous or resinous materials. Its coefficient of expansion is low, approximately .00002 per degree C. It is insoluble in practically all the ordinary solvents, is unaffected by ozone, and is impervious to moisture.

The other grade of Micarta has much the same mechanical and electrical properties but differs in its chemical and thermal properties. It behaves towards chemicals and heat very much as an ordinary resin does.

Fig. 2 shows a harmonic analysis of this break-wave from which it will be seen that the break is largely of one frequency with small sympathetic wave components of slightly lower and higher frequencies.

Sale of Assets

Tenders will be received by F. C. Clarkson, Assignee, at his office No. 33 Scott Street, Toronto, up to 12 o'clock noon on Tuesday, the 29th day of July, 1913, for the purchase of the following assets of the estate of the E. A. Greene Company, Limited, No. 145 Church Street, Toronto, consisting of, —Lot No. 1.—shades, lamps and sundries, $1,582.38; Lot No. 2.—office and shop furniture, $1,349.25.

Fuseless Rosette or Outlet Box Cover

The illustrations herewith represent a new device just placed on the market by the Pass & Seymour Company. It is called a fuseless rosette or outlet box cover and is made



Fig. 1.

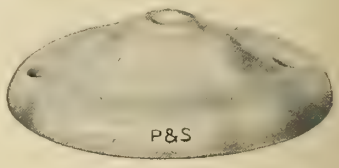


Fig. 2.

exclusively for use on outlet boxes. Fig. 1 is made for use on any of the 3-in. or 3¼-in. boxes, and Fig. 2 for use on any of the 4-in. boxes.

"Safety First" Signs

To fulfill the demand for safety appliances and to conform with the many "Safety First" campaigns carried on by railways, mining and power companies, the Electric Service Supplies Company have placed on the market a new type of illuminated sign as shown in the illustration. These signs consist of a steel frame joined at the top in the shape of a hood under which is placed a weatherproof socket for one incandescent lamp. The hood is given a coat of aluminium paint on the inside and acts as a reflector as well as a protection to the lamp. Standard enamel steel signs are attached to this frame by means of six machine screws, the standard size of the sign proper being 10 x 12 inches. These signs may read in several different languages like the one shown herewith, which portrays the message in English, Italian, Lithuanian, Polish and Slavok. They may be fitted with weatherproof condulets or bushings to protect the lead-



ing-in wires which enter the end of the hood, and to insure the proper operation of the sign after a maximum of rough usage.

These signs are used effectively in mines, power plants, and along railways or at any point where human life is endangered by exposed electric wires, switches or third rails. In mines where an illuminated sign is essential they are used extensively to warn the workman of the danger of gases, falling timbers and electric wires. For railway companies their use at stations and cross-overs to inform the public of possible danger is fully recommended. Their installation is undoubtedly an important step towards insuring the safety of workmen in mines and the patrons of railway companies.

New Books

Electricity for the Farm & Home—by Frank Koester, A.M.I.E.E. Sturgis & Walton Company, New York, publishers. Price $1.00 net. This book covers in a very helpful manner a number of the different phases of farm work as applicable to operation by electricity. The scope of the text can probably be best understood by an enumeration of the different chapters which are as follows:

(1) Benefits of Agricultural Electricity; (2) Central Station Service; (3) Generating Electric Power; (4) Electric Motor Application; (5) Cost of Operating; (6) Electricity in the Manufacture of Farm By-Products; (7) Electricity in the Preservation of Farm Products; (8) Electric Transportation of Farm Products; (9) Electric Ploughing; (10) Diverse Applications of Electricity; (11) Electric Heating; (12) Electric Lighting; (13) The Telephone in Rural Communities; (14) Electric Power in Irrigation; (15) Electric Stimulation of Vegetation. The book is well illustrated.

Electric Trucks

Two instructive booklets have just been issued by the General Vehicle Company of Long Island City, New York, dealing with "electrics" for grocers and department stores. Useful cost figures are given based on the satisfactory experience which has resulted from the operation of electric trucks under these two conditions. The operating cost figures including fixed charges, replacement charges, garage charges and driver and based on 300 days per year, are given in the following table. These figures are based on actual service in a large number of cities and under widely varying operating conditions, for electric trucks in service anywhere from six to eleven years.

Capacity	Speed	Annual Mileage	Cost Per Day
750 lb.	12	10,620	$ 6.30
1,000 lb.	12	10,500	6.85
2,000 lb.	10	10,140	7.65
2-ton	9	9,390	8.85
3½-ton	8	8,310	10.33
5-ton	7	7,200	11.60

Trade Publications

Glass Insulators—A mailing folder showing 43 designs of glass insulators has just been sent us by the Brookfield Glass Company, New York City.

High Tension Fuses: The Delta-Star Electric Company, Chicago, are distributing their copyrighted bulletin descriptive of their S. & C. Carbon-tetrachloride fuses for all voltages up to 110,000 volts. Numerous illustrations from actual installations in commercial operations are shown.

Fixture Parts.—Catalogue No. 2 issued by W. H. Banfield and Sons, 120 Adelaide street west, Toronto, describing their latest designs in ready-to-assemble fixture parts and fittings. These are made in stamped brass in any desired finish. This company also now have a branch factory at 362 Adelaide west, Toronto, to take care of their surplus orders.

Solderless Connectors—Tenth annual catalogue issued by Dossert & Company through Mr. Irving Smith, Montreal agent. The catalogue deals with Dossert solderless connectors for solid and stranded wires and includes, in addition to numerous illustrated descriptions, prices lists, code words, dimensions, and much other useful information.

Souvenirs—A handsome booklet was recently issued by the Owen Sound Board of Trade contemporaneously with the 24th annual convention of the Canadian Association of Stationary Engineers which this year was held in that town The booklet is profusely illustrated and forcibly sets forth the attractiveness of Owen Sound as a power and manufacturing centre.

Tips for Tourists—a folder issued by the British Columbia Electric Railway Company describing interurban side trips which may be made over the different railway lines of this company in the vicinity of the cities of Vancouver and Victoria. The Folder is well illustrated and also contains a map showing the extent of the company's lines.

Supplement Catalogue—The Electric Service Supplies Company have issued a new supplement to Catalogue 4, Volume 2, listing, describing and illustrating many new devices recently placed on the market by this company in addition to its line of car equipment and supplies. This new supplement catalog contains the first complete listing ever published of Imperial luminous arc head lights and parts and a full listing and description of Keystone Car Destination Signs. Other new devices listed are the International Coin Registers, Keystone Vacuum Sanders, Keystone Pneumatic Gong Ringing devices, Keystone Trolley Catchers, Keystone Steel Gear Cases, Keystone Trolley Pick-ups, Union Standard Trolleys, Sanitary Hand Strap Covers, Keystone Cord Connectors, Garton-Daniels Lightning Arresters, Automotoneers, Keystone Motorman's Seats, Keystone Lamp Guards, Keystone Air Valves and many other devices which will make it of great interest to operating men.

Recent C. G. E. Publications

How to Wire a House—an instructive pamphlet which points out that there is no reason for the supposition, unfortunately too common, that the wiring of a ready built house involves extensive alterations and turmoil.

Dossert Solderless Connectors—Dossert Connectors eliminate entirely the use of solder in making electrical connections and splices. By their use much labor is saved and splices obtained that will withstand any overload. They are described in a folder just issued.

How to Solve the Power Problem—is the title of an interesting little pamphlet issued by this company who can furnish a motor for every machine; a controller for every motor, and engineers to advise in their application.

Bulletin A4113—describing oil switches for small capacity industrial application. These oil switches, known as Type F, Forms P3 and P6, are designed specially for use in industrial plants in connection with induction motors of capacities not in excess of 25 horse-power at 600 volts, or with normal current ratings not greater than 50 amperes at voltages less than 600. They are arranged for mounting directly on a wall, post, or, where used with spinning frames in textile mills on the frame itself. When mounted on the spinning frame the switch is operated by a shipper rod. The live parts being entirely enclosed, the switches are particularly suitable for use in factories in which the air contains inflammable particles, or where explosive materials are prevalent.

The Century Electric Company announce that they have appointed the Rudel-Belnap Machinery Company, Limited, Canadian Express Building, Montreal, Que., as district sales agents for the provinces of Quebec, New Brunswick and Nova Scotia, who will handle the complete line of "Century" single phase motors, "Invincible" split phase motors and "Century" fans for the above territory.

The Good Salesman

It isn't what a man eats, but what he digests that makes him strong; not what he earns, but what he saves that makes him rich; not what he reads, but what he remembers that makes him learned—and it isn't the orders he takes, but those **he doesn't miss** that makes a salesman.

Current News and Notes

Aurora, Ont.

On August 4 a by-law will be voted on authorizing the expenditure of $21,000 on the electric distributing system.

Brandon, Man.

The first report submitted by Superintendent Antonisen on the operations of the new street railway system showed that the average daily number of passengers carried was approximately 2,900, showing average daily receipts of about $135 as against $105 for operating expenses, not including interest and sinking fund charges.

Calgary, Alta.

Following negotiations for the supply of power to the Western Canada Milling Company it is reported that the city of Calgary will develop the necessary power, using gas engines, and will sell to the company at $30 per horse-power year for 1,000 horse power.

Chapleau, Ont.

A by-law was submitted on July 21st approving a franchise agreement between the Chapleau Electric Light and Power Company and the corporation of the township of Chapleau. **The by-law was defeated.**

Carlyle, Sask.

On August 4th the electors of the town of Carlyle will vote on the question of expending $10,000 to provide an electric light and power system.

Fort Frances, Ont.

Following a re-organization of the railway system in International Falls, the town situated just across the Rainy River from Fort Frances, there is a suggested possibility that a belt line connecting the two towns would be a good business proposition and may be a reality in the near future.

Gravenhurst, Ont.

The corporation of the town of Gravenhurst are at present building a new concrete dam at South Falls to replace the old wooden one that has been in commission for many years.

Hamilton, Ont.

The Canadian Pacific Railway Company are considering the construction of a new line between Hamilton and Niagara Falls and passing through St. Catharines. It is said that this line may be electrically operated.

Hull, Que.

A by-law was recently passed authorizing the expenditure of $21,000 on a new generator to take care of 100 supplementary arc lights for street illumination.

Kingston, Ont.

Tenders will be called shortly in connection with the work of placing sections of the overhead distribution system underground.

London, Ont.

Mr. A. Eastman, manager of the Windsor, Essex and Lake Shore Railway Company, has completed an estimate on the earnings and operating expenses of the London and Port Stanley, under electrification. Mr. Eastman places the surplus over operating expenses at $75,000, against which there would be fixed charges of approximately $90,000, leaving a considerable calculated deficit.

Extensions to the main sub-station are under way. Contract has been awarded for the brick work to Hyatt Bros.

Medicine Hat, Alta.

Tenders will be called immediately for the erection of a three-storey telephone building. The exchange is being installed by the Alberta Government.

Montreal, Que.

The Builders' Exchange of Montreal is planning a big excursion of its members to New London, Conn., Aug. 15-18.

The Montreal Board of Control have refused to grant a site on Mount Royal for a wireless station, as requested by the Marine and Fisheries Department. The objection to the station is that it would disfigure that part of the mountain and would deprive the citizens of a portion of their park.

At Nobel, near Parry Sound, Ont., the Canadian Explosives, Limited, Montreal, are erecting a new plant, at which will be manufactured the various products of the company. Part of the plant will be operated by electricity, and for this purpose the company will install a generating set. There are to be two 125 kv.a. a.c. generators, supplied by the Canadian Westinghouse Company, direct connected to two 160 horse power Robb-Armstrong simple Corliss engines. The generators will be of the 600 v. 60 cycles type, while the motors, about 25 in number, will range from one to 20 horse power. This plant will also be used for electric lighting. The energy will be distributed by two power circuits and a lighting circuit.

The Canadian Crocker-Wheeler Company, Limited, of St. Catharines, Ont., have opened an office in the McGill Building, Montreal, under the management of Mr. Mugg. Prior to the opening of this office, the company's products were handled in Montreal through agents.

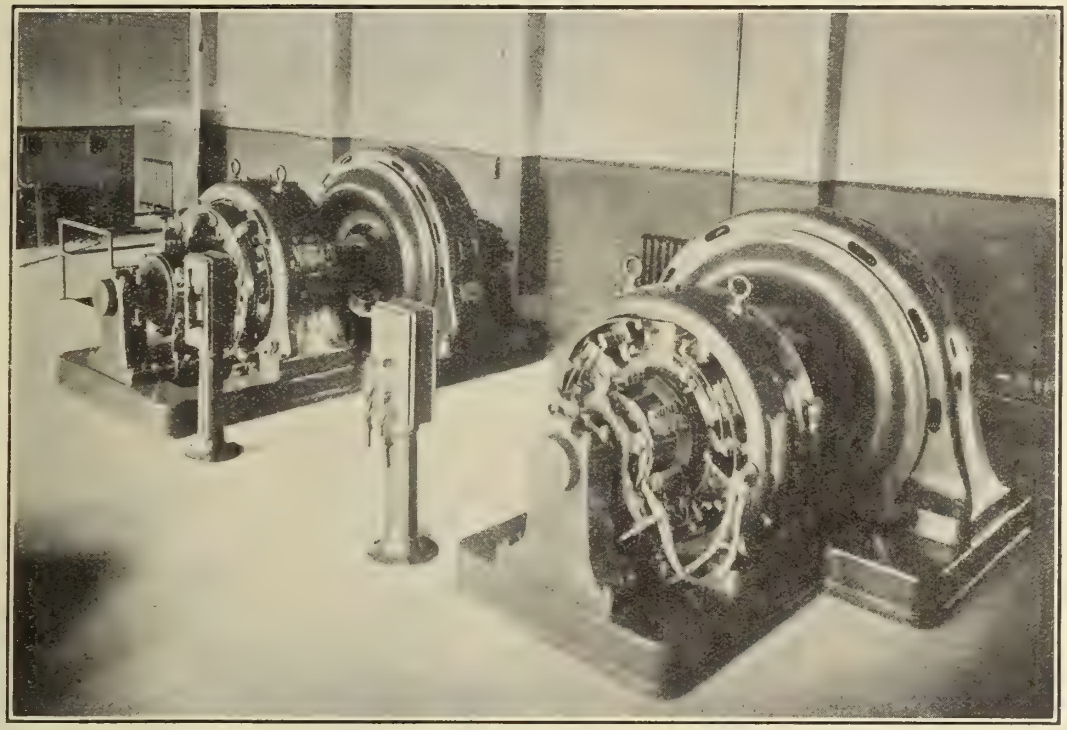
The Montreal Board of Commissioners have decided to accept the tender of the Canadian Allis-Chalmers Limited, Montreal, for the supply of an electric-driven pump, 6,000,000 gallons capacity, for the high level reservoir in that city. The amount of the tender is $6,356. The pump is to be built according to the design of Mather & Pratt's patent high lift turbine pump, and is to be direct connected to a motor. The pump will be manufactured at Rockfield, P.Q., is to lift against a total head of 266 feet, and run at 875 r.p.m. A 455 h.p. single unit motor is required, but the type is as yet not decided upon. The tender of the Allis-Chalmers Company was higher than others sent in, but the Commissioners accepted it on the recommendation of Mr. Janin, the chief engineer.

With a view to financing the addition to their hydro-electric power plant at Grand'Mere, P.Q., the Laurentide Company, pulp and paper manufacturers, have issued $2,400,000 of new stock. This will cover the estimated expenditure for the next two years. The work now proceeding will bring the present 22,000 h.p. up to 75,000 or 80,000 and eventually to 100,000 h.p. This increased development will provide for any probable future expansion of the company's mills, and at the same time afford a large amount of surplus power. The company state that enquiries have already been received for a considerable portion of this power at profitable rates. The present 22,000 h.p., which is entirely used for the work of the mills, afforded for the year ending June 30th, 1912, a net profit of more than $38 per h.p. The engineer is Mr.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE



One 400 K.W. and one 200 K.W. Siemens Self Starting Synchronous Motor Generators, supplied and installed for the City of Lethbridge

We have delivered or on order in Canada amongst others the following motor generators :—

1-800 K.W. Dominion Coal Co., N.S.
1-800 K.W. Canadian Collieries, B.C.
1-700 K.W. Canadian Collieries, B.C.
2-500 K.W. Winnipeg
2-500 K.W. Port Arthur
1-400 K.W. Lethbridge
1-250 K.W. Canada Sugar Refinery Co.
1-220 K.W. Dominion Coal Co., N.S.
1-200 K.W. Lethbridge
1-100 K.W. Northern Ontario Light & Power Co.
2- 70 K.W. Winnipeg Technical Schools
1- 70 K.W. Canada Motor Co., Winnipeg
1- 50 K.W. Medicine Hat

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Geo. Hardy, of New York, and the contractors the H. E. Talbott Company.

Some months ago, during the absence of the Mayor of Montreal, Ald. Mederic Martin, the acting Mayor, signed a contract authorizing the Montreal & Southern Counties Railway to extend their local terminal facilities—an action disapproved by the Commissioners. An action has now been entered by Mr. Donald Robertson, a shareholder in the Montreal Tramways Company, having for its object the setting aside of the signature of Ald. Martin on the ground that it is illegal. The action asks that the contract be cancelled and that the Montreal & Southern Counties Railway be refused the extensions authorized. The Tramways Company claim that the contract encroaches upon the privileges accorded the company by their original franchise. The Montreal & Southern Counties Railway have for a long time been asking for new terminal facilities, the present ones being wholly inadequate for the expanding traffic of that company.

It has been decided by the Montreal Tramways Company to obtain rulings, before the highest courts if necessary, in order to test the extent of the company's powers in dealing with passengers who refuse to comply with the regulations. The recent "no smoking" rule has resulted in considerable friction and several prosecutions.

Mr. W. H. Reynolds, western manager of the Eugene F. Phillips Electrical Works, Limited, Montreal, has been on a business visit to Montreal.

The Bell Telephone Company have opened a new exchange at the corner of Chateauguay and Charlevoix streets, Point St. Charles, Montreal. The great expansion of the business in the city is shown by the new directory just issued. Since February about 3,000 new names have been added, making a total of 46,368, of which 57 per cent. is for business purposes. It has been found necessary in order to reduce the bulk of the directory to arrange the names and addresses in two columns on a page and to reduce the size of the type.

New Toronto, Ont.

A by-law was recently carried authorizing the expenditure of $7,000 for the erection of a distribution system.

Ottawa, Ont.

It is reported a new bill will be introduced next session regulating the light and power rates charged by companies operating under Dominion charters. The power of regulating the rates would be fixed by the Dominion Railway Board.

The subscription rights for the new issue of $800,000 of capital stock of the Ottawa Light, Heat and Power Company, were all taken up by July 15th, the day the rights expired. The capital stock of the company is now $2,800,000 and the extra capital will be used to cover the cost of the new half million dollar gas plant now being built in Ottawa East as well as several improvements and alterations to the electric light system owned by the company. The new issue was offered to shareholders on record of July 1st at par. Each shareholder was allowed to buy one new share for two and a half already held. On July 15th Ottawa Power stock was selling at 168.

The Ottawa Electric Railway Company is adding five miles of tracks to their system this year at a cost approximately of $150,000. When these extensions are completed before the snow flies the total mileage operated by the company will be fifty-five. Two new booster stations, which have been mentioned in a previous issue of the Electrical News, are being built at a cost of $120,000; and $160,000 is being spent on twenty new double-truck cars, which will be ready some time early this fall.

Regina, Sask.

The operation returns for the week ending July 12 for the Municipal Railway System of the City of Regina was,—passengers carried, 95,251; revenue, $3,878.15.

St. Catharines, Ont.

The Bissell Motor Company of Canada, Limited, has been incorporated with a capital of $50,000, to manufacture and deal in electrical apparatus of all kinds with head office at St. Catharines.

Selkirk, Man.

On July 15th a by-law was passed favoring the operation of the electric railway system on Sundays. This probably means a Sunday service, in the near future, between Winnipeg and Selkirk.

Toronto, Ont.

Experiments will be made on the purification of water by electrolysis.

It is again rumored in connection with the purchase of the Toronto Railway and the Toronto Electric Light properties that the government may at the same time take over the generating plant of the Toronto Power Company, which supplies energy for the two Toronto companies.

It begins to look as if the Forest Hill line might not be constructed. The township council are opposed to the granting of a franchise.

By-laws authorizing the municipalities concerned to enter into contracts with the Hydro-electric Power Commission of Ontario, were carried by decisive majorities in Drumbo, Princeton, Plattsville and Ayr.

The committee recently appointed by the city council to make the report on the value of the assets of the Toronto Electric Light Company and the Toronto Railway Company have commenced their work and expect to have a report for submission to council by August 15th. The committee consists of Messrs. B. J. Arnold, R. A. Ross, J. W. Moyes, and John Mackay (chartered accountant).

The wage dispute between the electricians and the Toronto Hydro Electric Commission has been amicably settled according to the following schedule which rules for linemen, jointers, mechanics and helpers,—

Linemen,—Class A, 37 cents per hour; Class B, 34 cents per hous; Class C, 31 cents per hour. Helpers,—Class A, 30 cents per hour; Class B, 27½ cents per hour.

Cable jointers,—Class A, 38 cents per hour; helpers, 27½ cents per hour.

Electrical mechanics,—Class A, 41 cents per hour; Class B, 38 cents per hour; Class C, 34 cents per hour; Class D, 32 cents per hour. Helpers,—Class A, 30 cents per hour; Class B, 27 cents per hour.

It is also agreed that these men shall be given all legal holidays with full pay and alternate Saturday afternoons.

A site for the car barns of the St. Clair section of the municipal railway system has been purchased at Benson and Bracondale streets.

Windsor, Ont.

A police alarm system will be installed here and 3,500 feet of cable will be required.

Winnipeg, Man.

The Sons of Jove to the number of 150 recently held their annual picnic at Winnipeg Beach.

New tenders are called for the manufacture, delivery and erection in the generating station at Point du Bois, of two 5,000 kv.a., 3-phase generators for direct connection to double reaction turbines.



The WESTON SYNCHROSCOPE

Constitutes a very simple and absolute *perfect solution* of problems involved in coupling alternating-current machines in parallel without danger or sensible disturbance of circuit conditions.

The indications are infallible.

There is only one object to observe

The movement of the pointer is smooth and certain; it inspires confidence.

It indicates exact synchronism within 1 deg. of true phase coincidence over a wide range of frequency and voltage.

Send for catalog giving full *description of this unique instrument* and also our full line of A. C. and D. C. instruments for Switchboard, Portable and Laboratory Work.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

Weston Electrical Instrument Company,

Main Offices and Works
NEWARK, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 618 Union Trust Bldg.
Montreal, Winnipeg, Vancouver, Calgary — Northern Electric & Mfg. Co.
Toronto, 76 Bay Street.
London, Audrey House, Ely Place, Holborn.
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Berlin, Genest St. 5, Schoenberg
Johannesburg, So. Africa, F., Peabody Rice, Standard Bank Building, Harrison St.



Power Cables

Manufactured by

British Insulated & Helsby Cables, Limited

PAID-UP CAPITAL, $8,500,000.00

HEAD OFFICE—PRESCOT, ENG. Works at PRESCOT, HELSBY and LIVERPOOL

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

WRITE FOR ILLUSTRATED CATALOGUE

SOLE CANADIAN REPRESENTATIVES:

Canadian British Insulated Co. LIMITED

MONTREAL, QUE.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

Engine and Generator For Sale

Owing to the Town of Stayner having secured a supply of power from the Hydro-Electric Power Commission of Ontario this equipment will not be needed after Sept. 1st. 1913.

1 100 H.P. 2 cylinder vertical Fairbanks-Morse Gas Engine, complete with oiling system, 5 years old.

1 Fairbanks-Morse Gas producer, complete for above.

1 30 K.W. 1,000 volt, 133 cycle single phase Royal Electric Generator, complete with exciter.

1 set of line shafting, complete with pulleys, clutches and belts,

1 marble panel switchboard with control equipment for generator and exciter.

1 Bulldozer Power Pump.

1 Duplex Plunger Pump.

1 Water Motor.

JOSEPH KNOX,
Stayner, Ontario.

FOR SALE

Lights			Speed
2	450	Gen. Elec. type C. form T, direct-connected to Curtis form A non-condensing turbine, 100 lbs. pressure, 25 kw., 125 volt.	3600
2	450	Gen. Elec., 6-pole, form L, 25 kw., direct-connected to Westinghouse vertical gasoline engines	350
1	540	Gen. Elec., 6-pole, form F, comp., 30 kw. direct-connected to 11 x 8 in. Gen. Elec. vertical marine type engine, 125 volt	305
1	1300	Northern, MP, 75 kw., comp., direct-connected to Racine vertical cross comp. engine, 125 volt	275
1	1300	Westinghouse, 6-pole, comp., 75 kw., direct-connected to 14 x 14 Ames auto, center-crank horizontal engine, 125 volt	275

Send for our "Monthly Bargain Sheet" showing complete list of machines on hand with net prices. Every machine sold is completely overhauled and fully tested at our works before shipment, and is sent out practically "as good as new."

We Buy, Sell, Rent, Exchange and Repair.

GREGORY ELECTRIC CO.
CHICAGO, ILLINOIS

Established 1893.
1601 S. Lincoln Street. 14-t.f.

Car Ventilating Systems

The Cooke System of Mechanical Car Ventilation. Specifications and estimates furnished. Manufactured in Canada under Canadian Patent 128070. Vacuum Car Ventilating Co., 561 W. Monroe Street, Chicago, Ill. 11 t.f.

Nernst Lamp Scrap Parts

We purchase for cash Heater Tubes, Glower Ends, Burners and all kinds of Scrap Gold, Silver and Platinum. National Refining Co., Ltd., 81 Peter Street, Toronto. 13-14-16-18-20

For Sale

1500-light Dynamo, Exciter and Marble Switchboard, equipped with all attachments and instruments, all in first-class condition, for sale cheap; also one 13-inch LeFell Water Wheel, brass buckets, with wheel case, spur wheel and pinion. Box 819, Electrical News, Toronto, Ont.

Situations Wanted

Electrical Engineer, single, age 28, desires change. Seven years construction and maintenance work, Generators, Switchboards, Transmission lines, etc. Box 821, Electrical News, Toronto, Ont. 13-14

Engineer, electrical and mechanical, A.M.I.E.E. age 29, married. Commercial, practical and technical experience and training, good organizer, correspondent, salesman and advertiser. Author Engineers' Reference Book with world wide circulation. Requires position with opportunity for advancement. Box 501, G. P. O., Toronto. 15

Hydro-electric power house and central station construction foreman desires position on large construction work. Wide and thorough practical experience. Box 830, Electrical News. 14





For Rent—Cottages

If you want a real holiday, plan to spend your vacation this year in Muskoka where "the breezy call of incense breathing morn" will put new life in mind and body. Muskoka offers more real healthful enjoyment for less money than any other resort in the world.

Four cottages to rent $125 to $200 on Bohemia Island, less than a mile from Royal Muskoka Hotel and good Golf Links. Box 771,

Electrical News, Toronto Ont.



HOPE

Tapes and Webbings

for

Electrical Work

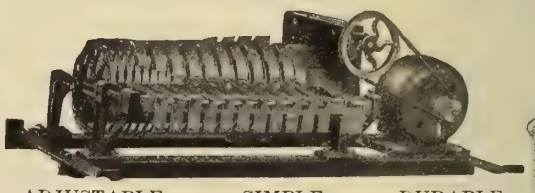
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Hope Webbing Company

Providence, R.I.

RECO FLASHERS

FOR ELECTRIC SIGNS AND DISPLAYS



Made in every style.



ADJUSTABLE -- SIMPLE -- DURABLE

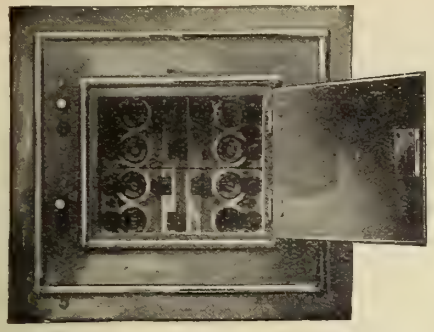
COLORED LAMP HOODS

GET OUR LATEST BULLETINS

Reynolds Electric Flasher Mfg. Co.

Largest Manufacturers of Flashers in the World.
Also Manufacturers of Billboard Reflectors, Time Clocks, Transformers, Window Displays, etc.

No. 1123 Broadway, **New York.** No. 617-631 W. Jackson Blvd., **CHICAGO**



A Radical Departure and Much Needed Improvement

COLUMBIA Push Button Switch Cabinets

Save Cost of Switch Box and Plates.

Push Button instead of knife switches eliminates all danger of accidental contact with live parts, besides assuring longer service, as it is well known that push button switches far outlast knife switches. These new cabinets are much superior to the regular panels and cabinets, they occupy less space and are lower in price. Lock type switches may be substituted for use in public halls, etc. Note the prices. Cabinets only.

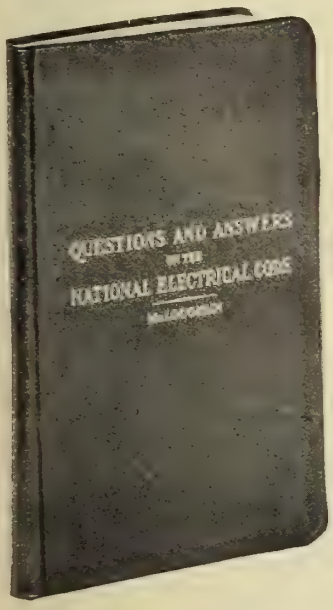
		Prices			
Cat. No.	Circuits	List	Cat. No.	Circuits	List
511	2	$3.50	515	10	$5.50
512	4	4.00	516	12	6.00
513	6	4.50	517	14	6.50
514	8	5.00	518	16	7.00

Write for Bulletin and Discounts

Columbia Metal Box Co.

226-228 E. 144th Street. NEW YORK

You Can Interpret the Code Instantly with McLoughlin's



Questions and Answers on the National Electrical Code

It tells at once the answer to the questions on code requirements. Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.

Every question is carefully indexed so that you can locate the fact you are after instantly.

Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.

Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.

The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding $1.00 (4/2) net, prepaid.

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Yager's Soldering Fluxes

4 Forms—1 Result—The Perfect Joint

Efficiency is the word. Let us co-operate with you to increase the efficiency of your service. Use Yager's Fluxes in any of the four convenient forms — Salts—Stick—Paste — Fluid, to produce joints which will not fail you at the critical moment. No acid in any of them. They make the perfect electrical joint.

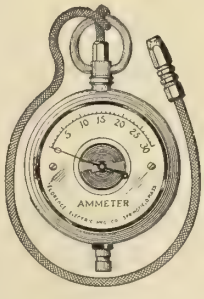
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ALEX. R. BENSON COMPANY

HUDSON, N. Y.



Pocket Battery Ammeters



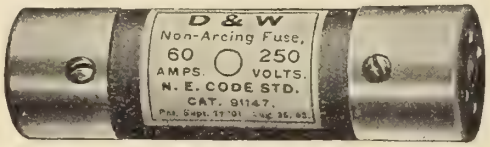
Voltmeters and Volt-ammeters, Small Switch-board Instruments, Lamp Testers.

Accurate, Durable.

Eldridge Electric Mfg. Co.

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The Sign of A Good Fuse



To ensure perfection in design, quality in material and efficiency in operation buy "D & W" Fuses.

They are the pioneers of enclosed fuses and are the result of careful research and long experience.

"D & W" fuses have many decided advantages over other makes.

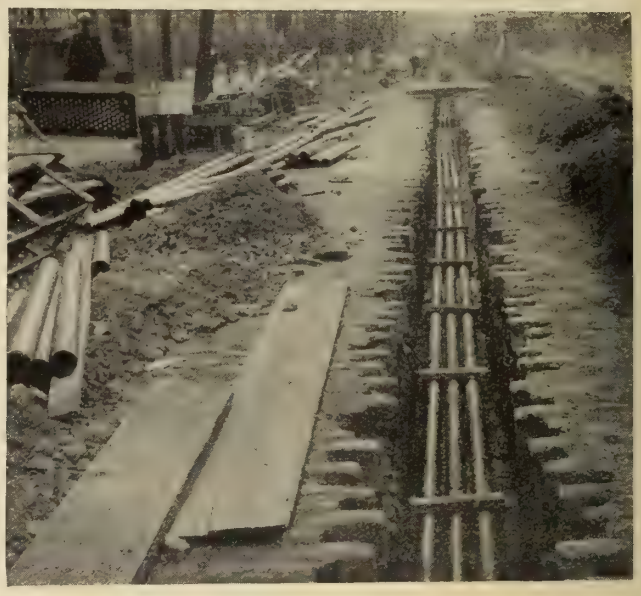
Other "D & W" specialties are fully described in our new illustrated catalog which shou'd be in the hands of every user of fuses. Send for Cat. No. 15 E to-day.

D & W FUSE CO., Providence R. I.

Canadian Representatives

THE Northern Electric AND MANUFACTURING CO. LIMITED

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Winnipeg Regina Calgary
Edmonton Vancouver



Manitoba Gov. Installation at Winnipeg.

Long Lengths 7 ft. Thick Walls 3/8 inch. Long Joints 5/8 inch,

We will absolutely guarantee a puncture strength of 50,000 volts and an absorption of moisture for 100 hours of less than ¼ of 1%.

Comparison of above figures with other types of Fiber Conduit will show the superiority of our product.

American Conduit Co.

East Chicago, Ind., U. S. A. 140 Nassau St., N. Y. City

Distributors for Canada:

The Northern Electric & Mfg. Company, Limited, Montreal, Halifax, Toronto, Winnipeg, Regina, Calgary, Edmonton, Vancouver.



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
Second, because it is the only renewable fuse that is uniformly rated.
Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

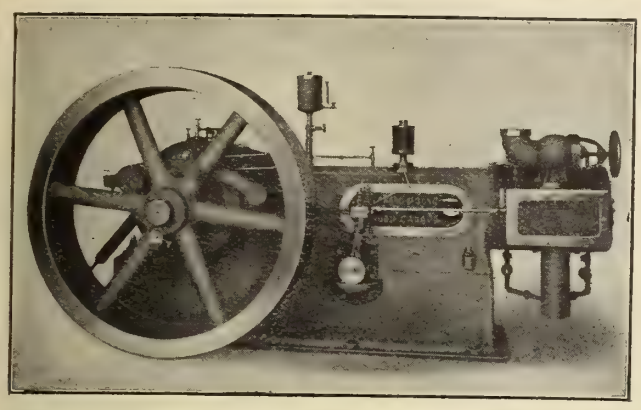
Special Announcement!

Two Economy Renewal Elements are now furnished without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

Economy Fuse & Mfg. Co. of Canada, Limited

Herald Building, Montreal



Engines of All Types
for
Electrical Service

BOILERS — HEATERS — PUMPS
TANKS AND STACKS

E. Leonard & Sons, London, Can.

AGENCIES: St. John, N.B. Montreal Toronto Winnipeg Calgary Vancouver

Single-Phase Motors

Where a Single-Phase Motor is required a Wagner Motor should invariably be selected. There is nothing in the Single-Phase line comparable with Wagner Motors for high starting torque and low starting current. They are "fool proof"; they have high overload capacity.

They may be started under full load without danger of excessive current demand with no further intermediary than a two pole single throw switch.



As Alternating Current Motor Specialists the Wagner Company offers the benefit of its twenty years of experience.

Correspondence invited.

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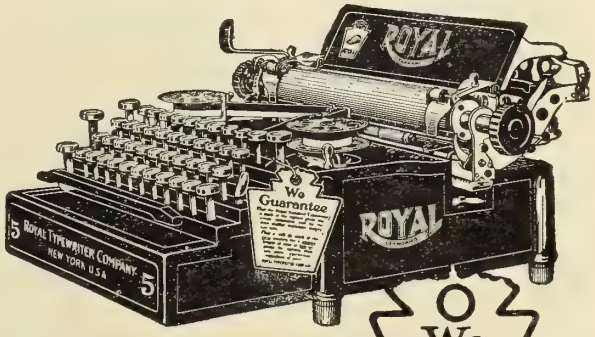
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Darche Reminder Clock



By merely placing a plug at any desired time, clock will cause an alarm.
Operated by dry battery.
Ready for use.

AGENTS WANTED

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$95.00

We Guarantee
That the Royal Standard Typewriter is made of the highest grade materials obtainable and by the most skillful workmen money can hire;
That it will do work of the best quality for a greater length of time at less expense for upkeep than any other typewriter, regardless of price.
ROYAL TYPEWRITER COMPANY

The ONLY machine for the Electrical Trade.
Special keys for electrical expressions furnished FREE.
Attractive terms for the electrical Fraternity.

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Permant Efficiency Plus Durability

SCHWARZE ELECTRIC BELLS

We make one grade of electric bells only—the very best that can be produced for all positions where an electric bell is desired and for all conditions of service.

No. 22, Standard Bell, illustrated herewith, is for use on Battery or High Tension, Direct Current Circuits. The bell is entirely insulated from the frame; is fully approved by the Underwriters; is remarkable for its quick response and instant stopping and is (like all Schwarze Bells) absolutely guaranteed.

Write for our Catalog—it is complete in its description and illustration of our high grade line.

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Do you know that 90 per cent. of the irons in laundries and manufacturing establishments (where 2000 to 3000 hours' work must be given every year) are Simplex?

Have you received your copy of the new range booklet? It points Do you know that one year at such service equals the requirements of ten years of domestic service?

SIMPLEX ELECTRIC HEATING COMPANY

Mfrs. of everything for Electric Cooking and Heating

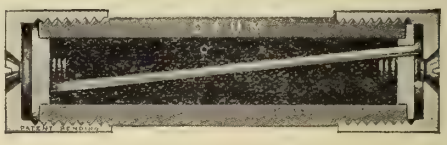
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CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.

SAN FRANCISCO, 612 Howard St.

the way to freedom from kitchen drudgery and will bring good business to you.

SIMPLEX EQUALITY



Of course renewable fuses are hazardous, so are revolvers, razors, etc., for incompetent users, but for the skilled engineer or electrician they are just the thing, and the reason the old type fuses have been tolerated as long as they have is because there has been nothing else to take their place.

Sample and Catalogue No. 15 for the asking.

A. F. DAUM COMPANY, PITTSBURGH, PA.

ASK US about Efficient Lighting

for your streets, factory, warehouse or yard

A. H. WINTER JOYNER, Ltd.

76 Bay Street, Toronto

"Consult A Specialist"

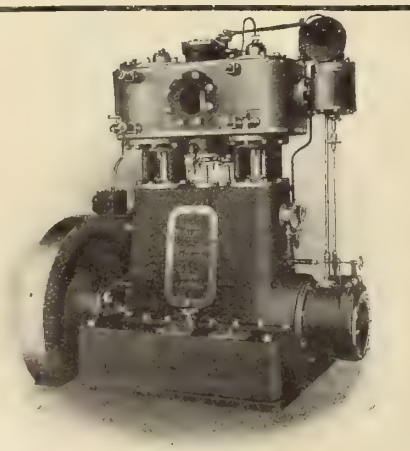
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FOR

Bus Bars
Railway Feeders
Transmission Line

Northern Aluminum Co.

1503-4 Traders Bank Bldg. TORONTO Limited



Vertical, Forced Lubrication

Quick Revolution Engines

With Combined Throttle and Expansion Governor

These engines are giving excellent service wherever installed. They are built for service and are economical in consumption of steam and require little or no attention while running. The materials used are in accordance with British Admiralty Specifications. Ask for detailed information.

All Engines are Tested under Steam before leaving our works

THE GOLDIE & McCULLOCH COMPANY, LIMITED

Head Office and Works: Galt, Ontario, Canada

Branches:—Toronto Montreal Winnipeg Vancouver and St. John, N. B.

Holtzer-Cabot

Wire Connectors

Insure a perfect joint every time

They are seamless and free from brazing or soldering.

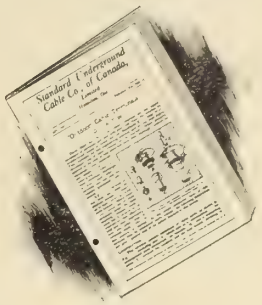
Sleeve and conductor are welded together into one solid homogeneous mass with 3 1/2 turns of an "H-C" Connector.

All sizes for solid or stranded conductors.

Why not try them?

Send for bulletin 208N.

THE
Holtzer-Cabot Electric Co.
Chicago, Ill. Brookline, Mass.



For Your Information

we have just issued our new Bulletin on Outdoor Cable Terminals. It describes and gives voltages, dimensions, weights, etc., of the following styles of terminals:

Terminals for Light, Power and Railway Service

Single Conductor Terminals
Multi-Conductor Terminals.
Multi-Unit Terminals

Terminals for Special Service

Inverted Terminals
Series Arc Terminals
Small Telegraph Terminals
Borehole Terminals
Mine Shaft Terminals
Pipe-top Terminals
Panama Canal Type Terminals

It also gives instructions for ordering and installing, etc. If you use cable terminals you should have this new bulletin.

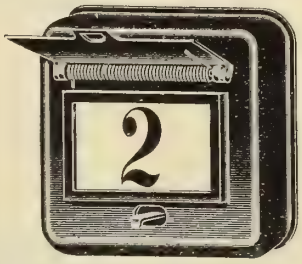
Write our nearest office for Bulletin No. 700-1C.

Standard Underground Cable Co. of Canada, Limited.

Montreal, Que. **Hamilton, Ontario** Winnipeg, Man.
Boston, Mass. Seattle, Wash.

BRITISH MADE
STERLING
TELEPHONES

No. C 6196
Unitype Indicator
Inexpensive



No. C 6196
Unitype Indicator
Practical

For ordinary Electric Bell work. Each movement complete in metal case with fixing bolts and nuts. Can be mounted in any number or design to suit.

Agents for Sterling British Made Phones:—

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ONTARIO.—Chapman & Walker, Ltd., 116-118 Richmond St. W., Toronto.
SASKATCHEWAN.—The Northwestern Electric Ltd., Scarth Street, Regina.
BRITISH COLUMBIA.—Cope & Son, Ltd., Water Street, Vancouver.
ALBERTA. — General Supplies, Ltd., 122 Eleventh Ave. W., Calgary.
QUEBEC.—Stocks kept by: Dawson & Co., Ltd., Montreal. Mechanics Supply Co., St. Paul, Que.
NOVA SCOTIA.—Stocks kept by: John Starr, Son & Co., Limited, Halifax.
NEW BRUNSWICK.—Stocks kept by: St. John Railway, Dock St.



"GOOD POLES QUICK"

for our Canadian customers means

British Columbia Cedar Poles

shipped from some one of our 14 pole yards in Canada. Our Canadian Stocks are by far the largest and most complete.

May we quote you?

The Lindsley Brothers Company

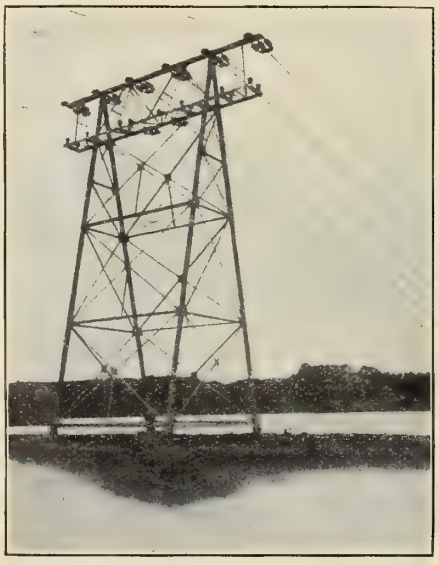
Spokane—Regina—Chicago

Construction Supply Co., Toronto Representatives

The Steel Company of Canada, Limited

Manufacturers of

COPPER WIRES AND CABLES



Consult us regarding—

Bare Copper Wire
Copper Trolley Wire
Copper Cable

for

Electrical Construction Work, Transmission and Trolley Systems

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VANCOUVER	VICTORIA	ST. JOHN	HALIFAX



7 CEDAR POLE YARDS IN B. C.—7

For prices on B. C. Cedar Poles address

WESTERN LUMBER & POLE COMPANY

Main Office - DENVER, COLO.

Toronto Agents—Federal Engineering Co., Ltd., 90 Sherbourne St.

NAUGLE

Pole & Tie Co.

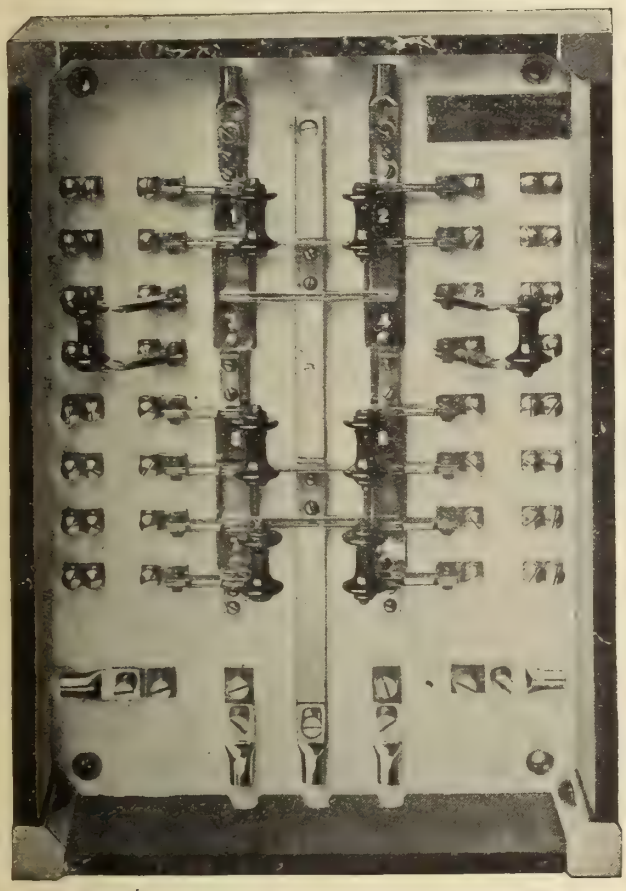
Main Office
5 South Wabash Ave.
Chicago, Illinois

We have yards in Canada guaranteeing our motto:
"SERVICE"
"PRICE" "QUALITY"
ONE QUALITY
ANY QUANTITY

POLES

KRANTZ

Switch Boards
and
Panel Boards



Specify a KRANTZ, WHY?

Because "Krantz" Switch Boards and Panel Boards are the recognized standard, always reliable and comply with every requirement of the Underwriters' Association.

They are used in many of the largest institutions, office and government buildings throughout Canada and the United States.

All enquiries given prompt and careful attention.

Canadian Agents:

The C. H. L. Keeler Co.
Limited

Toronto, Ontario

Use the Railway's Trolley Poles



as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

ERECO Combination Railway Lighting Pole Fixtures

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

Design No. 10127.

Electric Railway Equipment Co.

Cincinnati, Ohio

Designers **Manufacturers**

Canadian Representatives:

Dawson & Co., Limited, Montreal, Winnipeg

N. Y. Office, 30 Church St., Hudson Terminal Bldg.

Electrical Supplies of every description

A few of our specialties :

Moloney High Efficiency Transformers
Pass & Seymour Electrical Specialties
Carbon and Tungsten Lamps
Rigid and Flexible Conduit
Condulets
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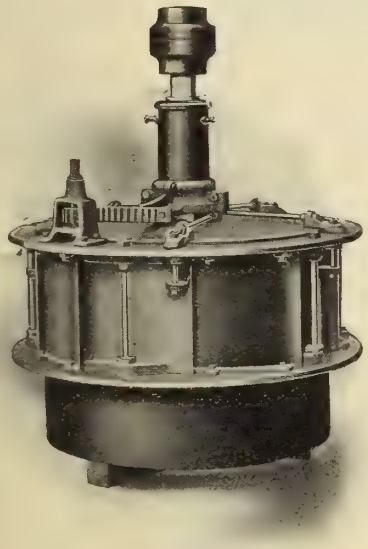
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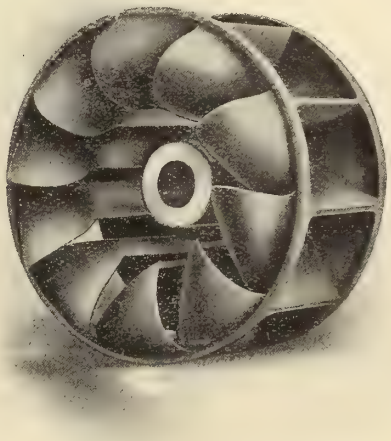
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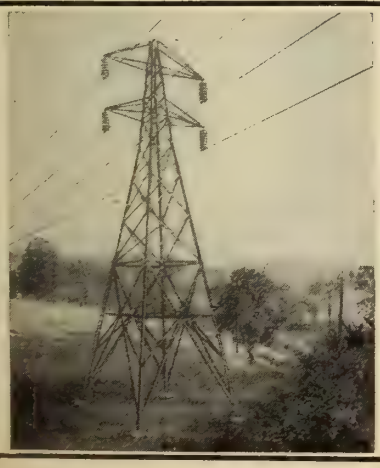
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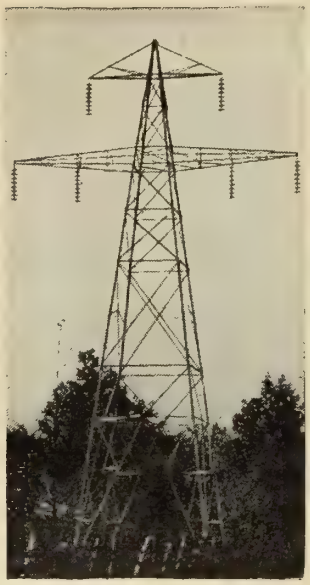
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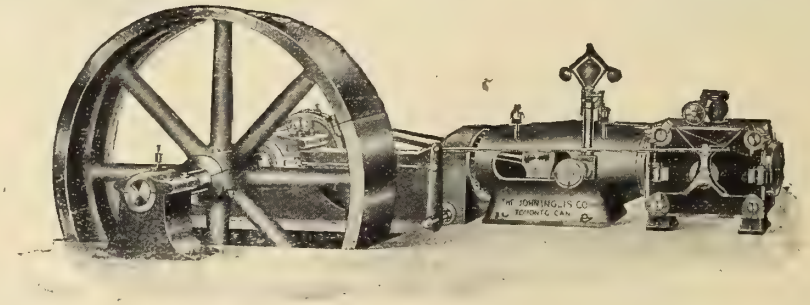
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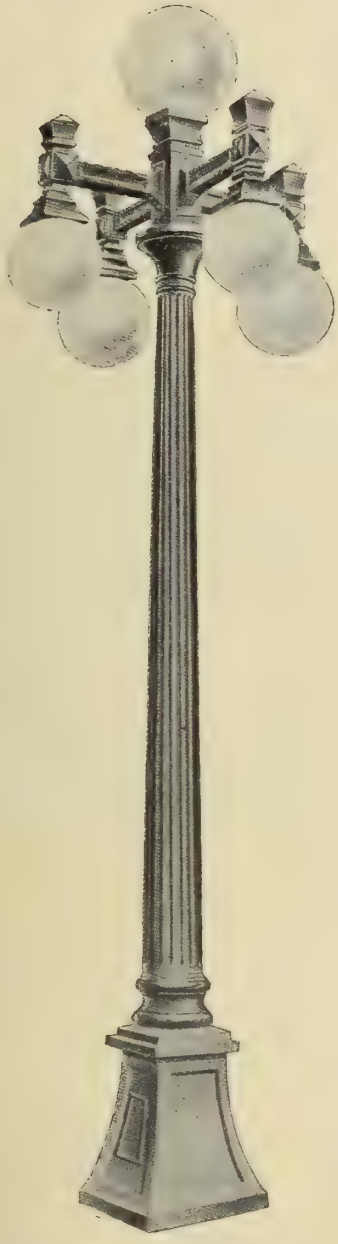
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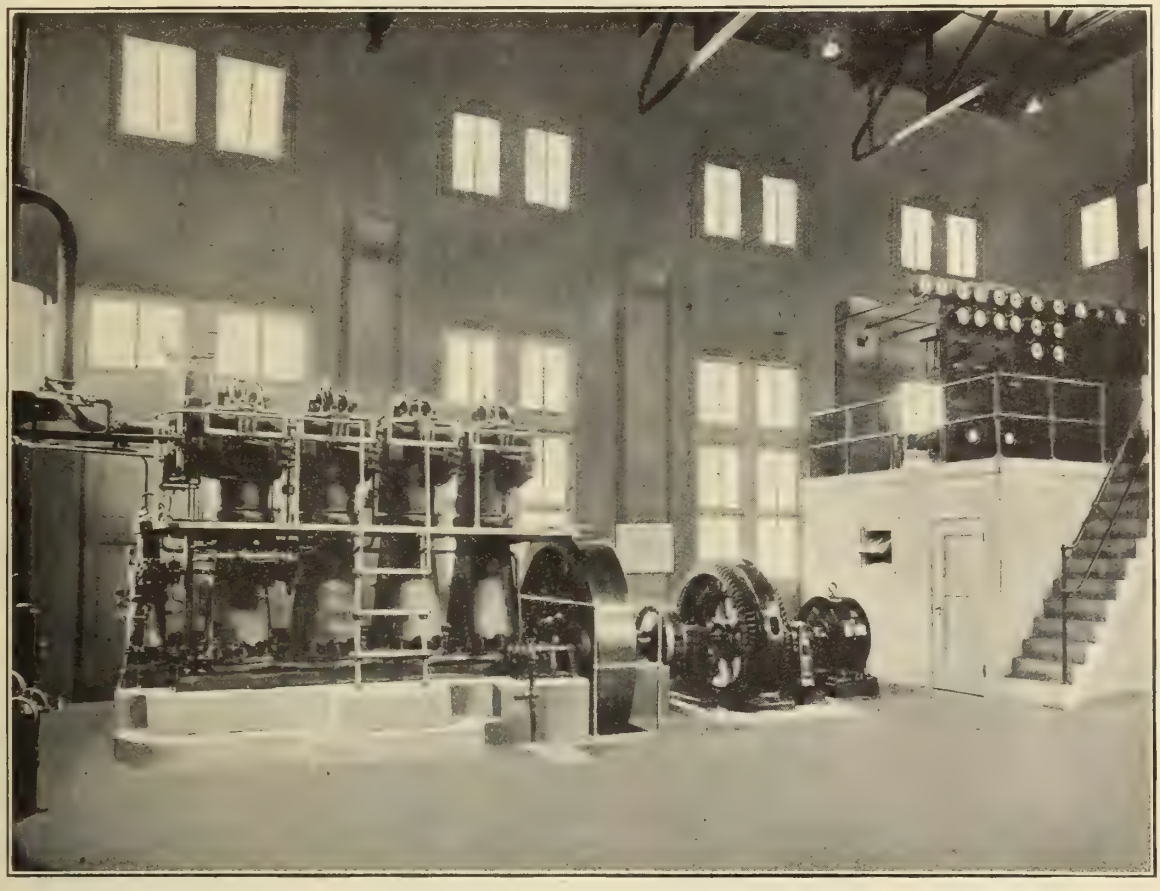
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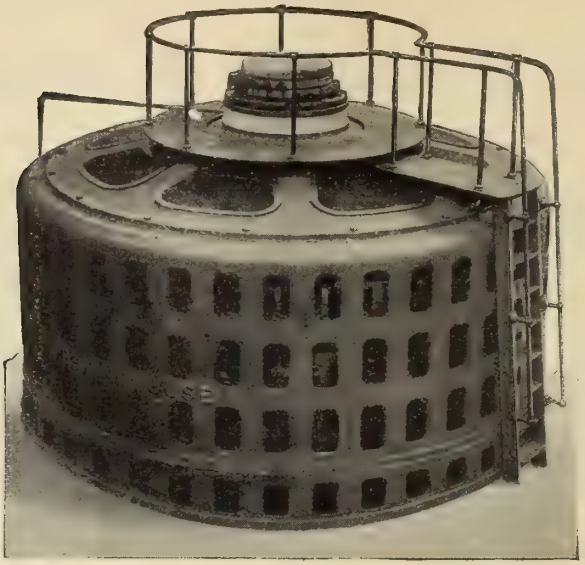
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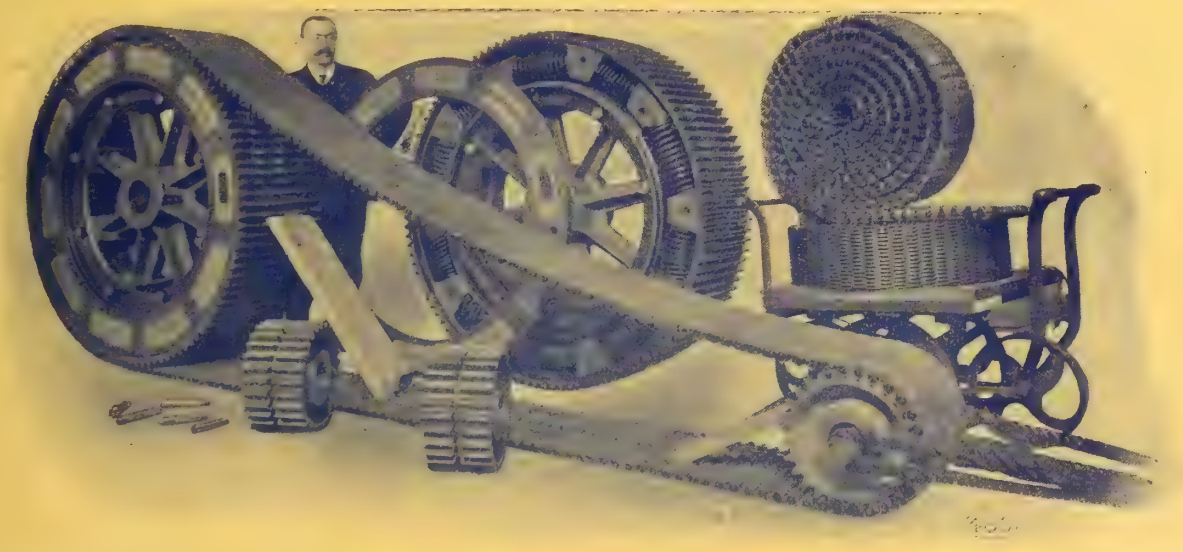
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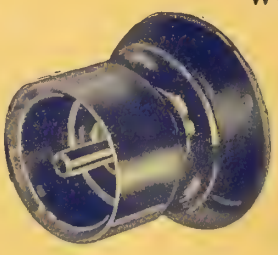
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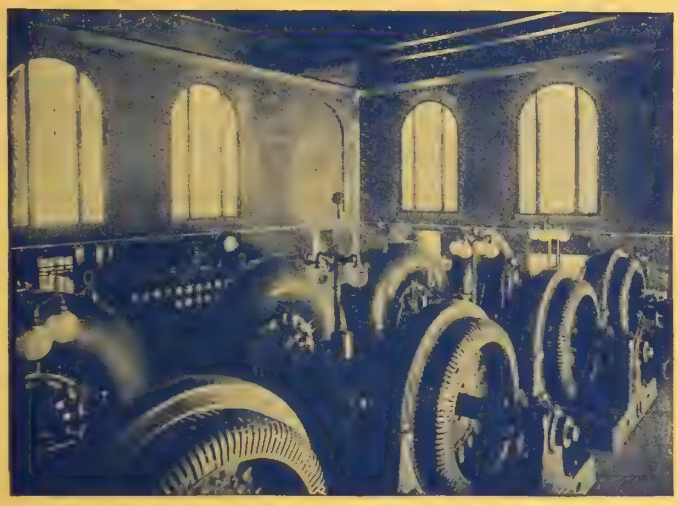
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Generation, Transmission and Application of Electricity



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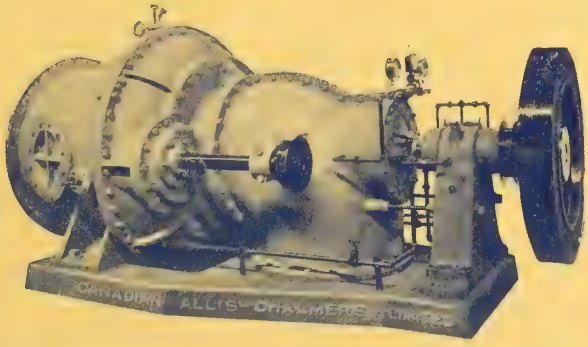
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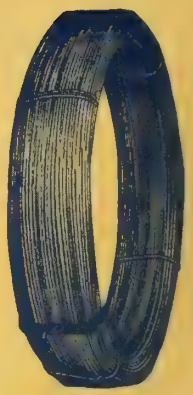
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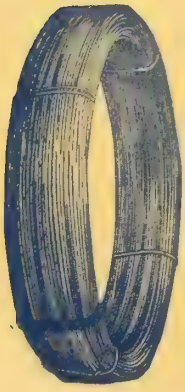
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Rosette





Cat. No. 870
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Cat. No. 1999
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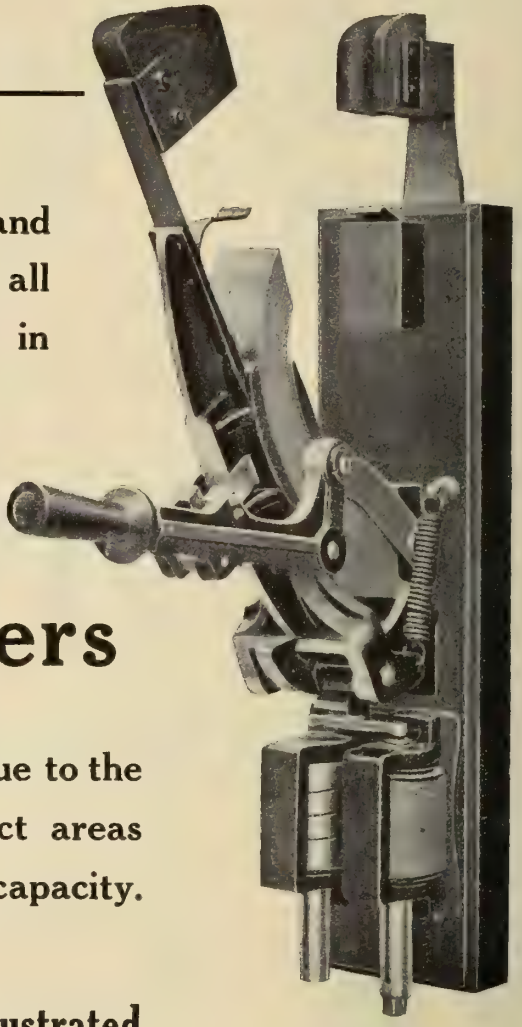
Cat. No. 61
Lamp Grip Receptacle



Cat. No. 247
Porcelain
Receptacle

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Their effectiveness and reliability is due to the very substantial design, liberal contact areas and cross-sections and great breaking capacity.

Construction of Style "A" here Illustrated

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Our bulletin T-2 on Switch-gear and Accessories gives a more minute description of this and other types.

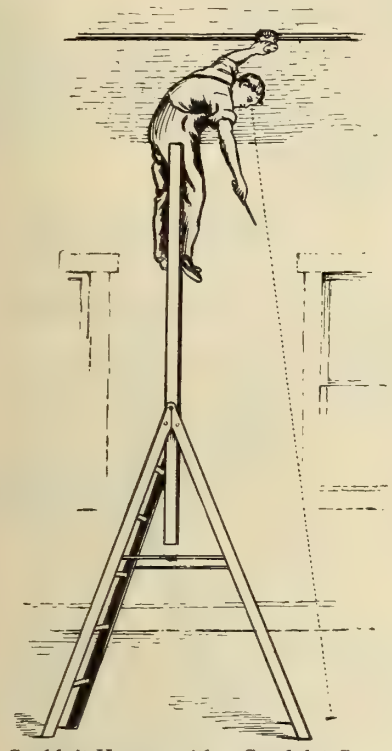
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Screws for Metal Covers are necked just under the head, and screw holes in covers are topped. When threading on screw has passed threading in hole, no shaking or knocks can make screw back out.



Screw for Metal Covers

NOTICE—This company has discontinued furnishing cover and fitting fastening screws with Condulets. These screws are now furnished with Condulet Covers and Conduletto Fittings for Condulets.

Crouse-Hinds Co. of Canada, Limited

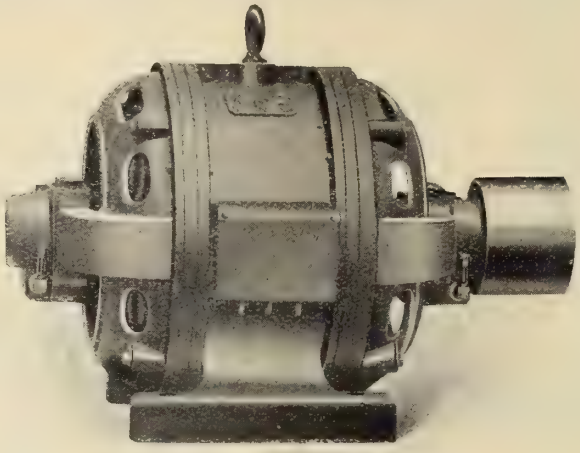
Main Office and Works:

Toronto, Ontario, Canada

"UNION" MOTORS

Stock carried at MONTREAL, TORONTO, WINNIPEG and VANCOUVER

High Efficiency
Great Overload Capacity
Ample Ventilation



Sound Mechanical Construction and Smooth Running

Pattern H.D. Squirrel Cage Motor

CANADIAN UNION ELECTRIC CO., LTD.

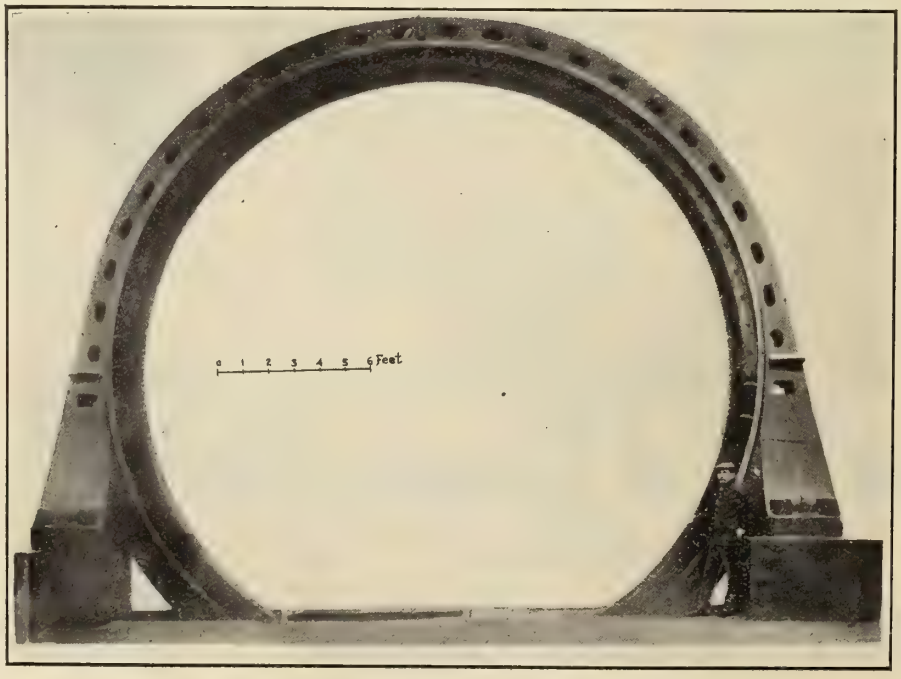
122 Wellington St., West
TORONTO

9 St. Nicholas Street
MONTREAL

THE MAINER ELECTRIC CO., LTD., 61-3 Albert Street, WINNIPEG, MAN.

Engineering Works of Canada, Limited

Head Offices: NEW Birks Building, MONTREAL, QUE.



Stator of a 1800 KVA Generator, 94 RPM.

Builders under the patents of the

Societe Alsacienne

Belfort (France) — Mulhouse, Grafenstaden (Germany)

ESTABLISHED 1826

Power Plants, Rolling Mills, Mining and Hoisting Machinery

STIGLER'S

Patented Passenger
— and Freight —

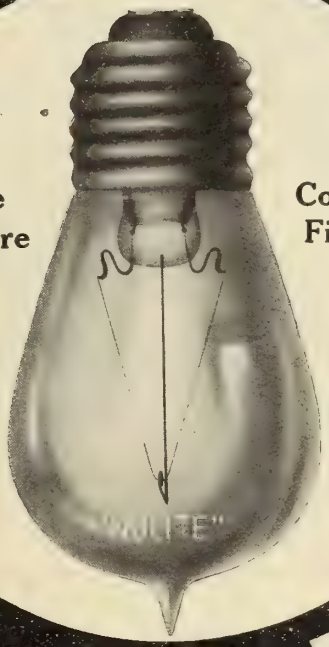
ELEVATORS

Descriptive Pamphlet of our Generators mailed upon request

"NULITE"

TUNGSTEN SIGN LAMPS

Genuine Drawn Wire



Continuous Filament

The Lamp With a Record

75 % of all sign lamps sold in Canada are 12 Volt — "NULITE" — 5 Watt

——— WHY ? ———

Quality—Durability—Efficiency—Economy

That's the reason———

"NULITE" A Canadian Product manufactured by

THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.
AGENCIES: T. McAvity & Son, St. John, N. B.; Farquhar Bros. Ltd., Halifax, N. S.;
Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto Ont.

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Free Press Building, Winnipeg
A "GALVADUCT" Building

"GALVADUCT"

The popular conduit of the Canadian people used in most of Canada's largest buildings.

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated.

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

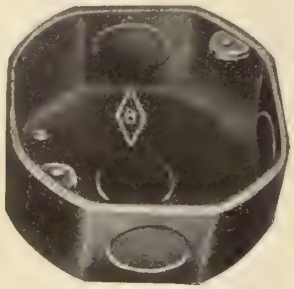
"LORICATED"

Conduits Company, Limited

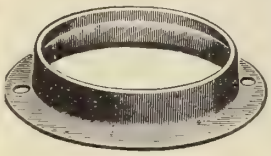
Toronto - Montreal

Made in Canada

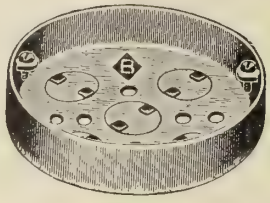
Iron Conduit—Conduit Boxes—Pipe Fittings and Accessories



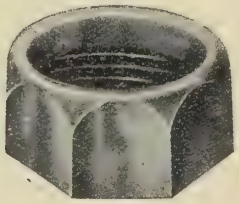
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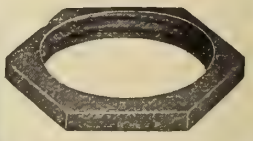


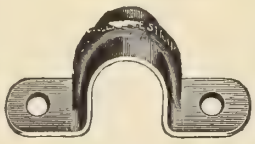
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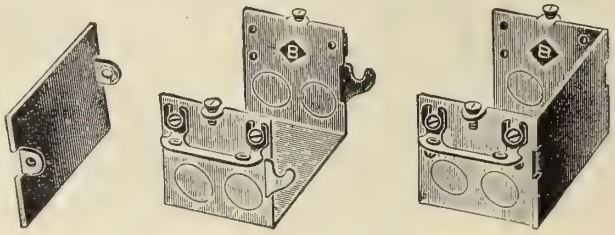


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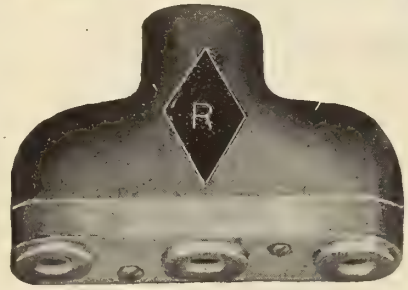


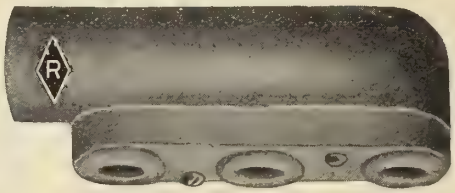


Type C 3″ deep—C C S-2″ deep
side comes off and does away with carrying two gangs

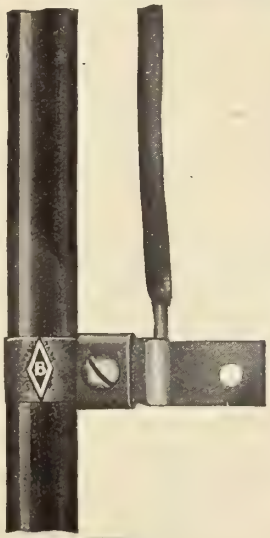


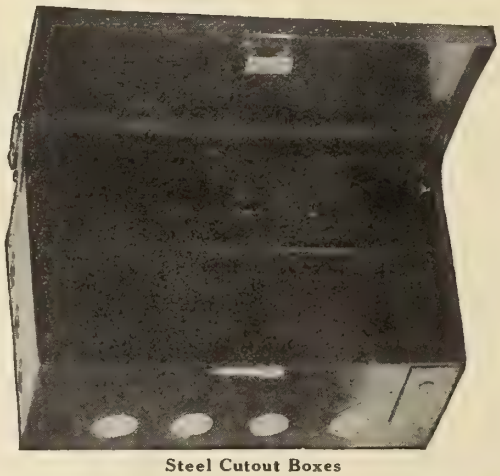
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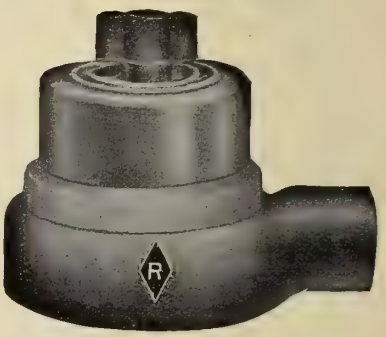






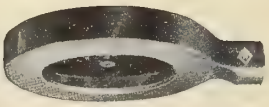


Steel Cutout Boxes



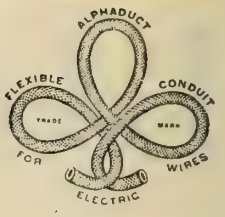






Type P





Write for Catalog No. 4



Electrical Fittings Co., Limited

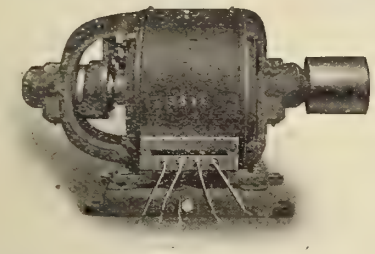
331 King St. West, Toronto, Canada

Munderloh & Company, Limited
Montreal, Que.

John Starr Son & Co., Limited
Halifax, N.S.

St. John Railway Company
St. John, N.B.

"BELL" High Efficiency Single Phase Motors



Meet All Requirements

Large stock carried throughout the country for immediate shipment.

Attractive Prices consistent with QUALITY

Our bulletin No. 138 which fully describes them will be sent to all interested.

Bell Electric Motor Co., 30 Church Street, NEW YORK CITY
LICENSED. Factory, GARWOOD, N. J.
Canadian Representative:
The Masco Company, Ltd., 205 Yonge St., Toronto, Can.
Stock carried in Canada

Something New
Darche Reminder Clock



By merely placing a plug at any desired time, clock will cause an alarm.
Operated by dry battery.
Ready for use.

AGENTS WANTED

Darche Mfg. Co. - Chicago
15 N. Jefferson St.

IRON HOUR SERVICE

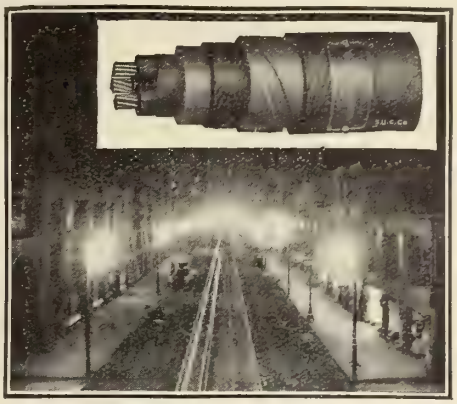
If you realize that our best references are those who have used Simplex irons for ten years or more in their business—who have used their equipment 30,000 hours and more—you can understand the value of

SIMPLEX IRON HOUR SERVICE

SIMPLEX ELECTRIC HEATING COMPANY
Mfrs. of everything for Electric Cooking and Heating
BELLEVILLE, ONT.
CHICAGO, 15 S. Desplaines St. **CAMBRIDGE, MASS.**
SAN FRANCISCO, 612 Howard St.

Have you received your copy of the new range booklet? It points the way to freedom from kitchen drudgery and will bring good business to you.

SIMPLEX EQUALITY



Illumination of Dearborn Street, Chicago, Ill.; "STANDARD" Steel Tape Armored Cable installed.

Have You Considered

the advantages of installing steel tape armored cable directly in the ground without conduits or manholes? There are many ways in which such cables can be employed with great economy.

"STANDARD" Steel Tape Armored Cable

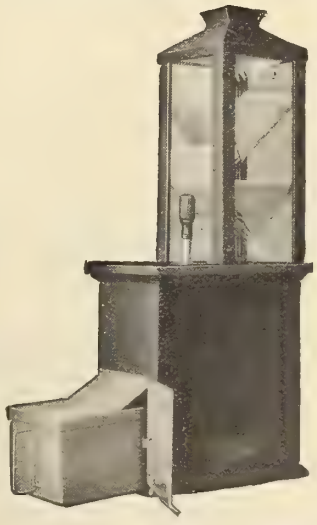
is a high grade product which has been tested by many years service. Our new Bulletin on Steel Tape Armored Cable contains valuable data on this subject for your files. *A card brings it.*

Standard Underground Cable Co., of Canada, Limited

Montreal, Que. oston, Mass. **Hamilton, Ont.** Winnipeg, Man. Seattle, Wash.

THE
PAY AS YOU ENTER

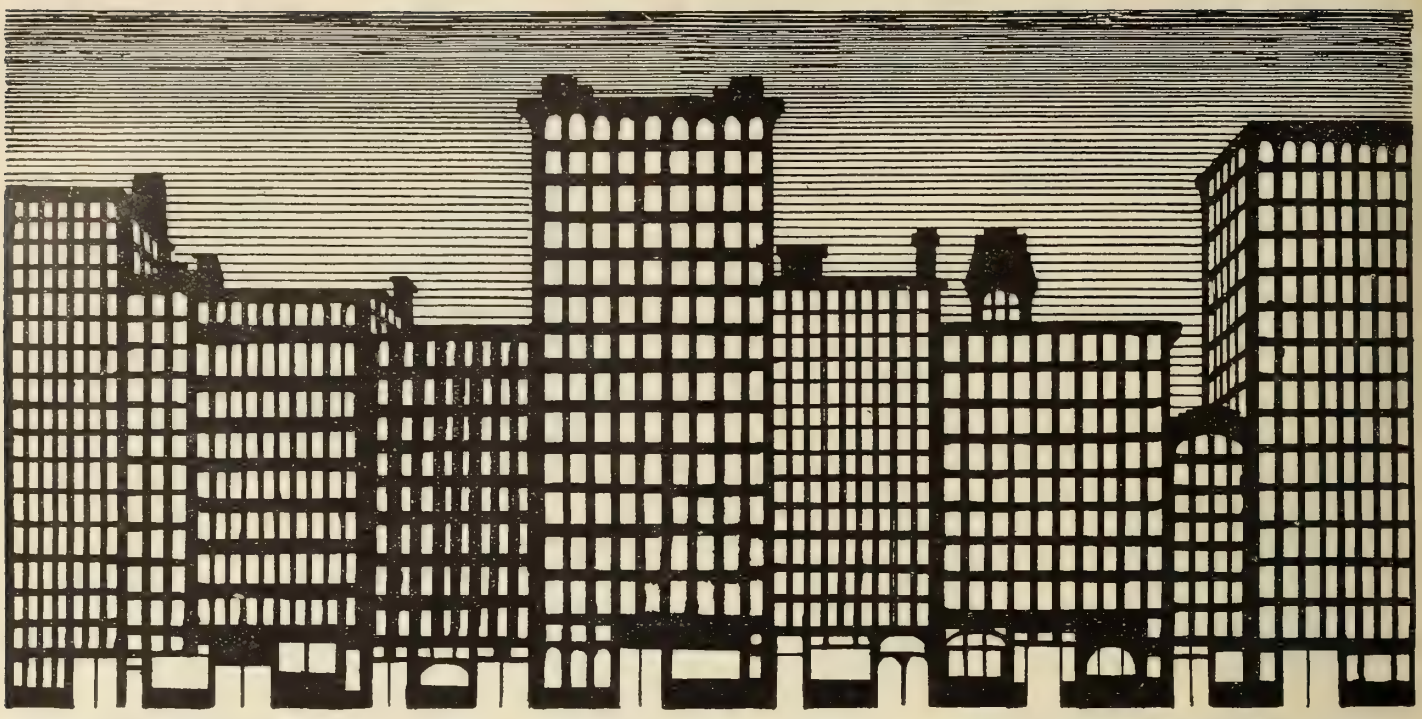
system has been put to the test on many Street Railways, and is now fully acknowledged to be a success. Success in this system is synonymous with the **Cleveland Fare Box.**



Cleveland, Detroit, Pittsburgh, Erie and many other cities gave the preference to the Cleveland—a striking testimony of its excellence.

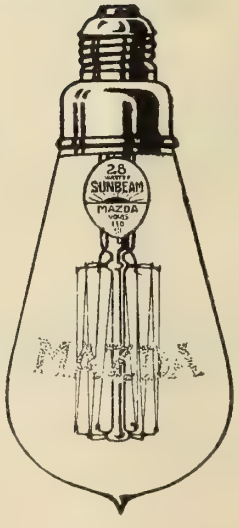
Write for booklet giving mechanical details

Cleveland Fare Box Co.
5310 St. Clair Ave., Cleveland, Ohio



The Question of Brilliant Better and More Light narrows down to this

Sunbeam Lamps



Sunbeam Lamps

Canadian Sunbeam Lamp Company Limited
TORONTO

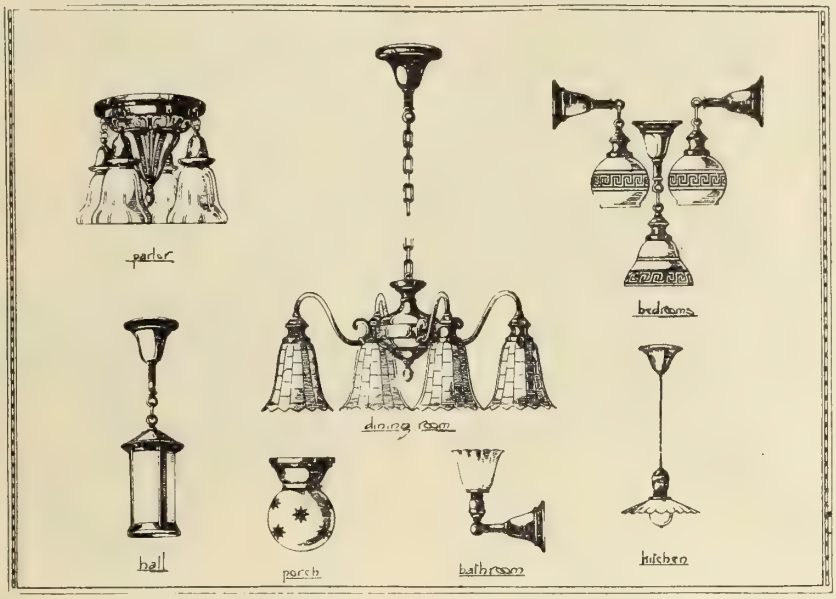
Branch Warehouses:
MONTREAL WINNIPEG
CALGARY VANCOUVER

Tungstolier De Luxe Set

9
Fixtures
Perfectly
Finished
Wired Complete

Less Lamps
and Glass

Packed in one
Box



$19.50
Net Price
to the
Trade
Only

Order a
Sample Set

It Will Bring
You Business

WRITE FOR ¼ SIZE DRAWINGS

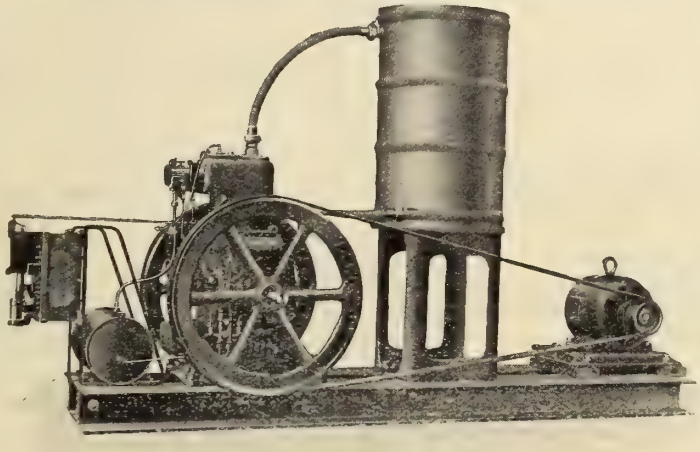
The Tungstolier Company of Canada Limited
212 King Street West, TORONTO

LISTER-BRUSTON

AUTOMATIC ELECTRIC LIGHTING and PUMPING INSTALLATION

Suitable for Lighting

Small Towns
Country Houses
Bungalows
Hotels
Clubs
Churches
Schools
Etc.



Protected by Patents
all over the
world.

SELF-STARTING
SELF-STOPPING

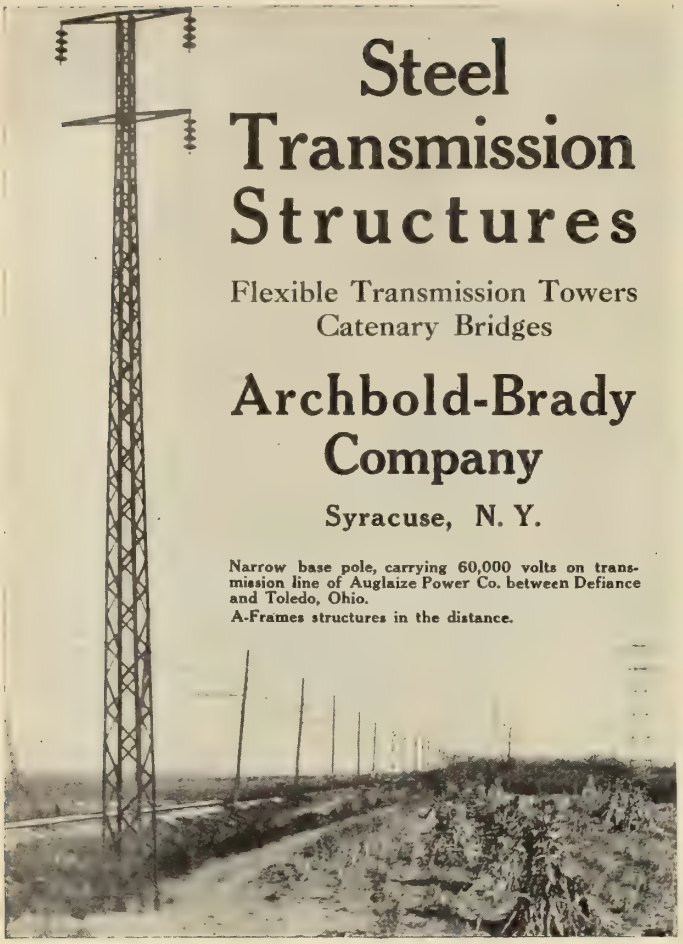
Upon request we can
show you

Write for Catalogue and Full Particulars to

R. A. LISTER & COMPANY, LIMITED

Winnipeg TORONTO St. John, N. B.

Plant in Operation at 190 King St. West, Toronto



Steel Transmission Structures

Flexible Transmission Towers
Catenary Bridges

Archbold-Brady Company

Syracuse, N. Y.

Narrow base pole, carrying 60,000 volts on transmission line of Auglaize Power Co. between Defiance and Toledo, Ohio.
A-Frames structures in the distance.



Parallel Screw Clamp.



Chicago Grip for Insulated Wire.


Chicago Grip for Bare Wire.


Quick Samson Grip for Guy Wire.



Havens Grip for All Around Work.


"Comealong" for Fence Work.

WIRE GRIPS FOR EVERY JOB

If you require tools for line work turn to KLEIN.
Here we display a few wire grips covering a range from trolley to fence wire, and every type is doing service throughout the world.

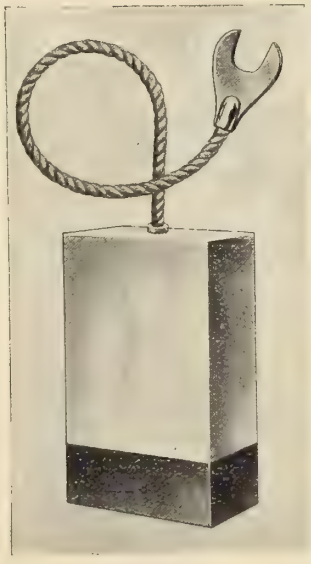
Klein Tools Have Wired the Earth

and these grips were employed in the work.

Klein Products

are carried by the leading Electrical Supply and Hardware merchants.
Write us for a catalogue, then order from your most convenient source of supply.

Mathias Klein & Sons
Canal Station 59
Chicago, Ill.



Becker Dynamo and Motor Brushes

Becker brushes are famous for their fine texture, perfect lubrication and freedom of grit or materials liable to damage the commutation.
Becker brushes are long lived and are made in every size and shape.
Get our catalogue containing prices.
Send us your inquiries for any style of Gauze—Carbon or Magneto Brushes.

Becker Brothers

561 W. Washington St. CHICAGO, ILL.

The Splendid Record of Delica White Lighting Glassware

¶ If it can be said of an article that it is a splendid seller all further particulars may safely be neglected because **no article can achieve a great and lasting sales record unless it be founded upon genuine merit.**

¶ That is eminently true of Delica White. It sprang into popularity the day it was first shown, and its career since then has been truly a triumphant one. **Unquestionably it stands without a peer in popular favor.**

¶ Adequate provision is made for direct and semi-indirect installation—electric and gas. Our new catalogue illustrates them. You need that catalogue, Mr. Merchant **and your trade needs Delca White.** Write our nearest branch—just now.

The Pittsburg Lamp, Brass and Glass Co., of Canada, Limited

119 Wortley Rd.
London, Ontario

PITTSBURGH

R. E. DAVIS
Representative

Both well lighted and well illuminated.

There is a distinction



Many stores and offices are well lighted, but poorly illuminated

Office of the Toronto Hydro Electric System.
One of the best lighted and illuminated offices in Canada.

The Holophane Realite promotes greatest efficiency in illumination.
Endorsed by all aggressive and up-to-date central stations.
A big opportunity for live contractors and fixture dealers.

The Holophane Co., Limited, Toronto, Can.

Clip the coupon below, sign and mail to us for copy of booklet fully listing our complete line of

"UNILETS"

TRADE MARK REGISTERED

TRADE MARK REGISTERED

The new modern fittings drawn from steel (superior to ordinary cast iron fittings). "Unilets" are mechanically right and add to the appearance of the job on which they are installed. Your copy of booklet is ready—write us at once.



Cat. No. 9000



Cat. No. 9002



Cat No. 9004



Cat. No, 9006

RECTANGULAR STEEL UNILETS FOR ½ IN. TO 3 IN. CONDUIT INCLUSIVE.

Appleton Electric Company

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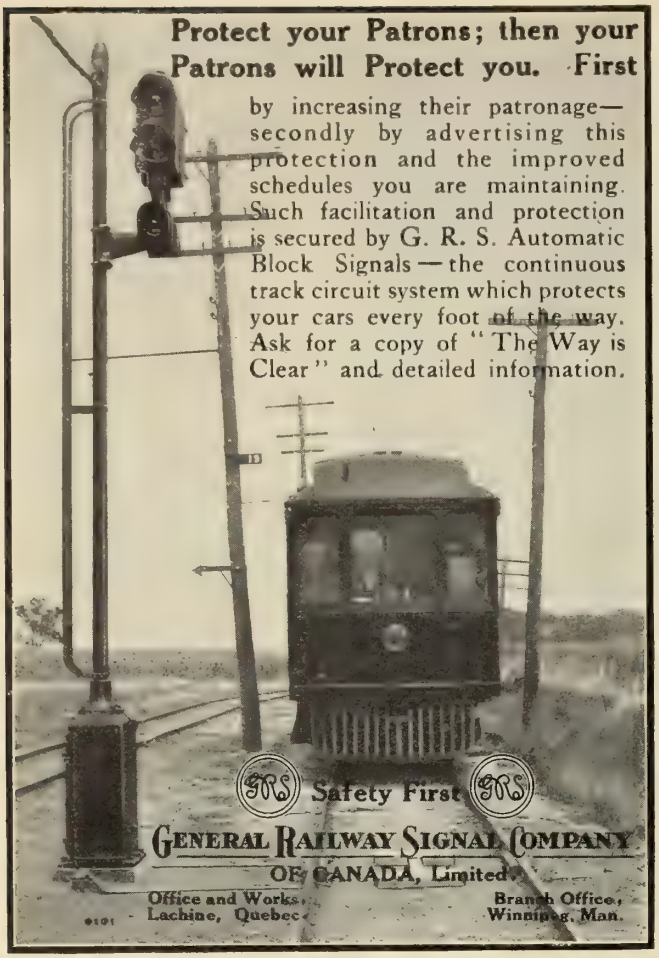
APPLETON ELECTRIC CO.,
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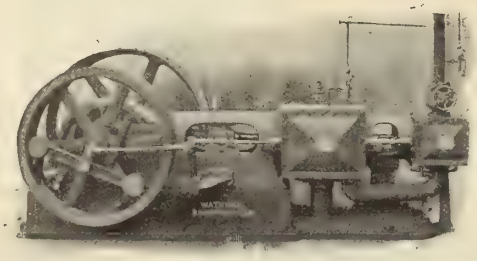
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Prices right and service prompt.

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110 Summer Street, Boston, Mass.

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Backed up by a guarantee

READ IT—"The Engine shall not run one revolution slower when fully loaded than when running empty, and a reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of the engine one revolution."

For the Economical Generation of Electric Light and Power

Close regulation—the first essential for this class of work—is provided in the McEwen Engine by the famous Begthrup Inertia Governor.

Simplicity and accessibility of all parts, great strength and the ability to absorb a large overload without change of speed, are distinguishing features of the McEwen.

The merits of this engine have been shown not so much by its good performances under favorable conditions or when carefully nursed on the testing floor, but by its splendid record under all conditions, good, bad and indifferent, of actual practice.

Built in simple and compound units up to 700 h.p.

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The
Waterous Engine Works Co., Ltd.
Brantford, Canada

Murray Patents

The old openwork method of installing meters is due for

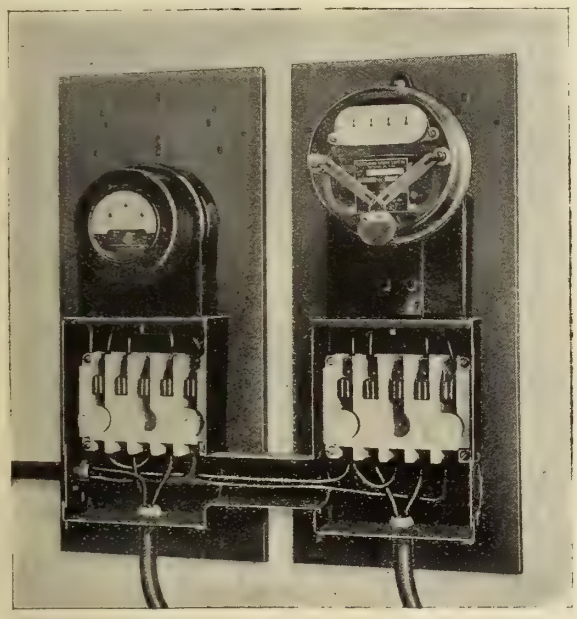
A Total Eclipse

It involves unsatisfactory service, unsightly and defective installations.

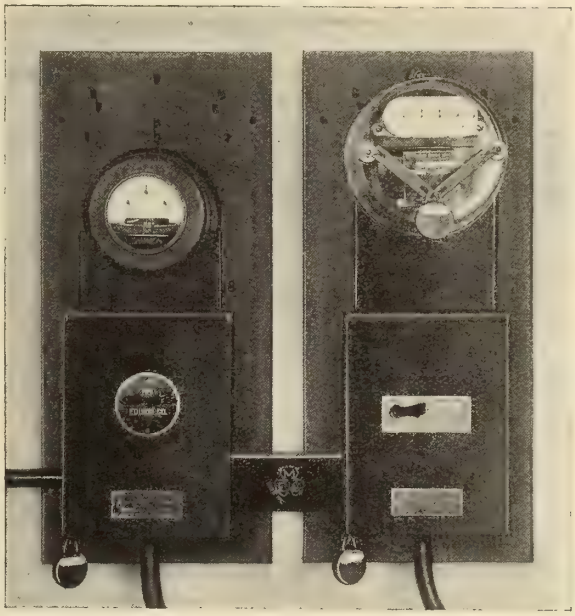
Modern Practice Demands

Sealed services, protection of your property and current until after it is metered.

One type of installation showing "Metropolitan" Metal Meter Boards, Adapters, Cut-out and Testing Block and Steel Cabinets also Wire Conduit Connector used where more than one meter is installed on a service.



With covers off after wiring is completed.



With covers on, service and whole device sealed complete.

Write for illustrated catalogue and detail information of our devices.

Metropolitan Engineering Company

of Canada, Limited

90 Sherbourne Street

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MICA

KENT BROTHERS

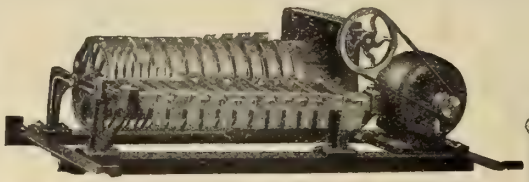
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Miners, Exporters and Dealers in Canadian Amber Mica.

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Largest Manufacturers of Flashers in the World.
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LIMITED

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A large and varied stock carried at our Winnipeg warehouse including

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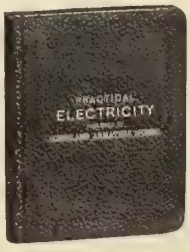
is to ship standard supplies the day order is received

ELECTRICAL MACHINERY

AND REPAIRS

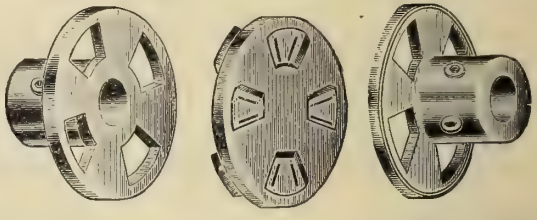
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Armature Shafts
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Commutators New, Refilled or Assembled



Every electrician should have a copy of this book. Price - $2.00 delivered

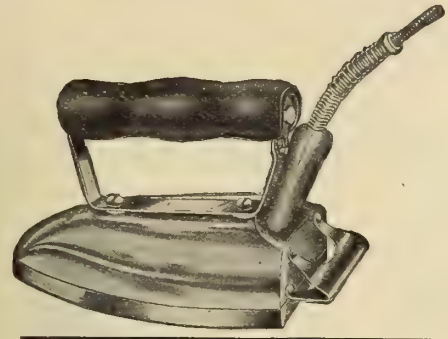
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This Simple Insulated Coupling

is flexible enough to work perfectly where the shafts are not in alignment. Small but powerful—stands sudden strains. It's called the Grundy Flexible Insulated Coupling.

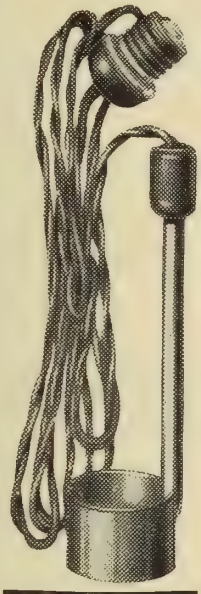
Canadian Bond Hanger & Coupling Co., Limited
Alexandria, Ont.



An Important Message To Canadian Dealers

We are shipping more "IDEAL HEAT" Electric Irons into Canada this year than in all previous years put together. There must be—yes there ***is*** a ***mighty good*** reason why this is so.

We have been making the old style sad, and Mrs. Potts irons for over 20 years—dealers throughout Canada have been handling them for years and are continuing to do so. Our vast experience in the building of irons puts us in a position to make Electric Irons far better than the average manufacturer, because we thoroughly understand the ***principles of ironing—heat distribution, shape, etc.*** Is there any wonder then, when a dealer learns that we are making Electric Irons that he will handle no other?



The "IDEAL HEAT" Electric Iron

unlike most other irons is ***not*** made solely to sell at a "price." Hundreds of Dealers who were stocked up last year with "make shift" irons—irons that merely consist of certain pieces of iron, a heating element, cord and plug, stamped, boxed and labeled "an Electric Iron" made only for quick sale, regardless of results, have come to ***know*** the IDEAL HEAT Iron is vastly different and far superior to the majority of irons. And not only will they sell no other but they are selling ***twice*** the number and with ***less effort.*** Then too every sale "sticks"—no lost profits from returns. The IDEAL does ***better work,*** in ***less time*** and ***costs less*** to operate than any other. That's the kind of an iron to sell. Better not sell any unless you have the BEST.

The

IDEAL One Minute Water Heater

is another device that has proven itself to be a ready seller. Has a hundred and one uses—For professional men, doctors and dentists; for nurses and invalids; for use in the home, for cooking purposes, heating small quantities of water quickly. For heating baby's milk at night. Very economical to use.

Both the Iron and Water Heater are quick sellers, and the profits are liberal. Every dealer should stock both devices.

LOETSCHER-RYAN MFG. CO.

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Ornamental-Luminous - Arc - Lamp -



The Lamp That Stimulates Business



Wherever this new Ornamental Street Lamp has been installed merchants are unanimous in their praise of it, because this handsome "white way" has considerably increased business.

Civic pride is aroused, citizens are taking more interest, are showing a greater enthusiasm and are more loyal towards their city than ever before.

This not only means increased trade to the merchants from residents but also from surrounding cities.

The New Ornamental Luminous Arc Lamp gives a brilliant, soft, white light, and by day the artistic poles add a charm and attractiveness to the thoroughfare.

A bulletin "de luxe" showing many installations and describing this new system of Ornamental Street Lighting will be mailed on request.

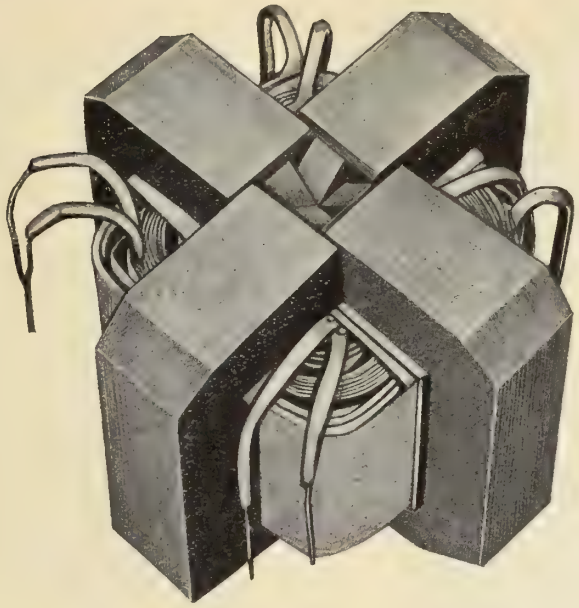
CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
Cobalt Regina Edmonton Porcupine Saskatoon Nelson Prince Rupert

Faultless core construction is one of the essentials of long transformer life.



Examine the type "H" core and see why it meets the ideal conditions for long life.

Type H Core and Coils Before Compound Treatment

The Ideal Core Is Designed for:

1. Balanced Magnetic Conditions.
2. Effective Radiation of the Heat.
3. Absolute rigidity to prevent humming, chafing of the insulation or displacement of parts.
4. Negligible Loss.

The Type "H" Core

The four magnetic circuits of low reluctance and of equal length and cross section insure perfectly balanced magnetic conditions.

The large core surface exposed to the cooling action of the oil effectively radiates the core heat. The symmetrical arrangement of the core in conjunction with ample oil ducts and thin coils insures uniform temperatures throughout the transformer, absence of hot spots within the winding or crawling of the layers due to unequal expansion.

The above cut shows the mechanical interlocking at the center of the core which in itself assures perfect rigidity. Permanency of position is secured by top and bottom clamps which bind the core leg and which are securely bolted to the tank. Displacement of the magnetic circuits due to rough usage, alternate contraction and expansion of the windings or vibrations resulting from the alternating current are impossible.

The use of non-ageing alloy steel gives lowest possible losses which do not increase with age. Every lamination is carefully selected and tested.

Not only the core but every part of the type H Transformer is made with the same purpose in view—**to lower your depreciation rates and increase your service efficiency.** The ability of the type H to meet these requirements is demonstrated by the hundreds of thousands of type H Transformers in use today.

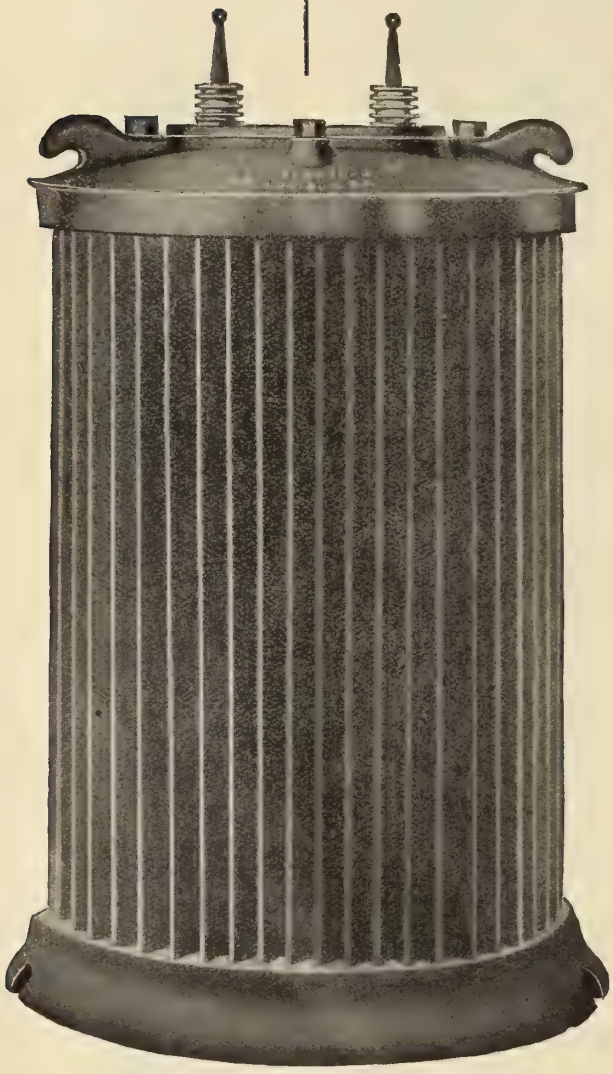
CANADIAN GENERAL ELECTRIC CO.

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Head Office: TORONTO

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MOLONEY OIL-COOLED TRANSFORMERS



THIS type of Moloney transformer is built for heavy duty and will give efficient service on high voltage lines.

Oil ducts are provided for coils and core, giving to all parts free contact with the circulating oil.

Corrugated sheet metal sides are cast solidly into cast-iron bottom. All strain is carried by the inside bolts which secure the cover to the bottom casting.

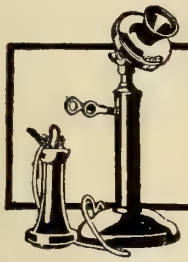
All lead wires are brought out through heavy porcelain bushings in the top of the cast-iron cover.

This transformer is fully described in our illustrated catalogue.

Canadian Moloney Electric
Company, Limited

WINDSOR, ONTARIO

Complete Stocks at **Windsor, Winnipeg, Vancouver**



SAFEGUARD
YOUR SERVICE

THERE are more than 500 telephone "troubles" in Jacksonville every day due to telephone receivers being left off the hook.

Your telephone is reported "Busy" or out of order when the receiver is left off the hook, no one can call you and you are likely to suffer serious inconvenience.

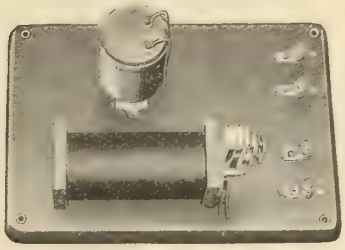
On duplex and party lines all telephones on the line are rendered useless when any one of the receivers is left off the hook.

When you receive a call for a person who answers at an extension telephone, see that your receiver is replaced as soon as the telephone is answered.

Watch your telephone, see that employees are careful to replace the receiver, your service will be improved and you will aid us to increase the efficiency of the service throughout Jacksonville.

May we have your co-operation?

SOUTHERN BELL TELEPHONE
AND TELEGRAPH COMPANY



Safeguard Your Service

BUY A HOWLER

Spare your subscribers and yourself delays due to receivers being off the hook

The Kellogg howler (illustration above) is one of our standard induction coils with interrupter and condenser mounted on a nicely finish, oak panel.

It can be screwed up on the wall or set horizontally on a table or on the switchboard.

It is connected to the line through cord and plug at the board. Simply insert the plug in the jack "of the offending party" and work the key. A good lively "howl" is the result. If desired the apparatus can be connected to the wire chief's desk and he can do the signalling without carrying through the board.

Settle this "receiver off the hook" annoyance with dispatch. Buy a howler.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

MAIN OFFICE AND FACTORY: CHICAGO

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B. C. HOLST & COMPANY, VANCOUVER, B.C.

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Grecian Lantern

Lanterns and Canteloupe Ball Globes are decorative and efficient Being made of **Moonstone Glass** the absorption of light is less than from any other semi-translucent glass on the market

The Grecian Lanterns and Canteloupe Ball Globes are made in five different sizes—illustrated in Moonstone Bulletin No. 1



Canteloupe Ball

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Porcelain

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Composition

An electric fan without a simple, efficient, quick-acting plug is as useless as a knife without blades.

The plug is the business end of the fan. If it doesn't work right, the fan is a failure.

Hubbell Interchangeable Plugs will put real whizz into the fans you sell. They will help you sell all sorts of electrical appliances for the home, store and office.

There is a Hubbell Plug for every need—a need for every plug. Tie up to this live line and pull in the profits.

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Let us quote you prices. It will save you money.

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ELECTRIC VACUUM CLEANERS

are the only cleaners that will positively and with the greatest ease pick up threads, ravellings, lint, hair, etc. This is an exclusive feature and not to be found on any other machine on the market. **Mechanically** they are perfect. Every part entering into their construction is of the very best material that can be obtained for the purpose intended. The fan is direct connected to the shaft of the motor insuring durability.

Send us an order for a trial machine, compare it with other makes, point for point and you will be convinced that it stands supreme in a class by itself.

Made in two sizes—"Hurley Six" and "Hurley Four"

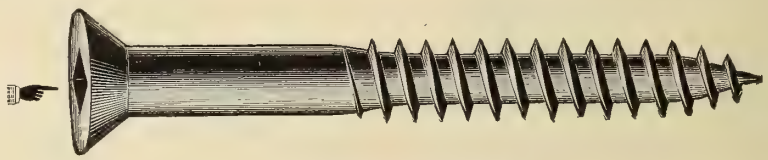
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The largest Electrical Supply House in the West

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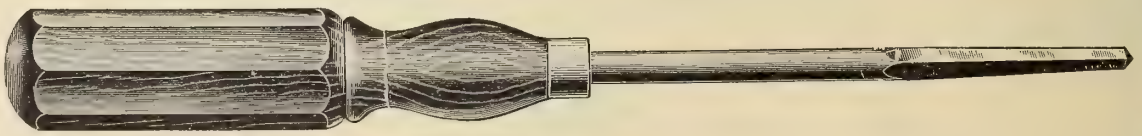
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ROBERTSON SOCKET HEAD
WOOD SCREWS

This new socket screw can effect a wonderful saving of time and material especially in electrical wire and fixture erection, etc.

They are used by simply placing the screw on the driver and then you may reach out at arms length and drive it in with one hand. For overhead work or work between joists or under flooring it is invaluable.

Samples and prices on request



The P. L. Robertson Manufacturing Co., Ltd.

Milton — Ontario

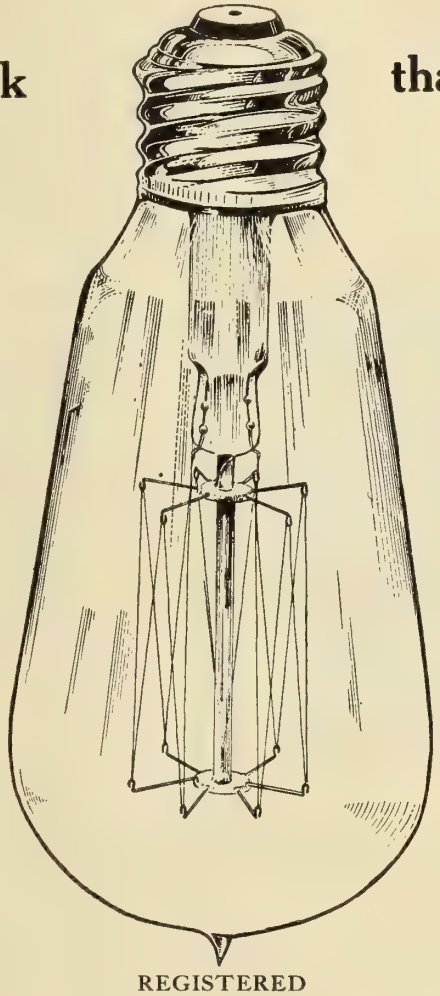


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Packard **Mazda**

The Trade-mark that *insures* Quality



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Characteristic of all "Packard" products is their superior quality and High-Grade workmanship.

It is this high standard of service and efficiency which makes the "Packard" Mazda drawn wire Tungsten lamp so popular wherever sold.

We wish to acquaint every dealer in Canada with the reduction in price of "Packard" Mazda lamps which went into effect August 1st. While the price is reduced ***the quality remains the same.***

Large stock of Tungsten and Carbon lamps carried at St Catharines and Winnipeg from which we can make prompt shipments.





You should get our New Schedule of Prices.

The Packard Electric Company, Limited

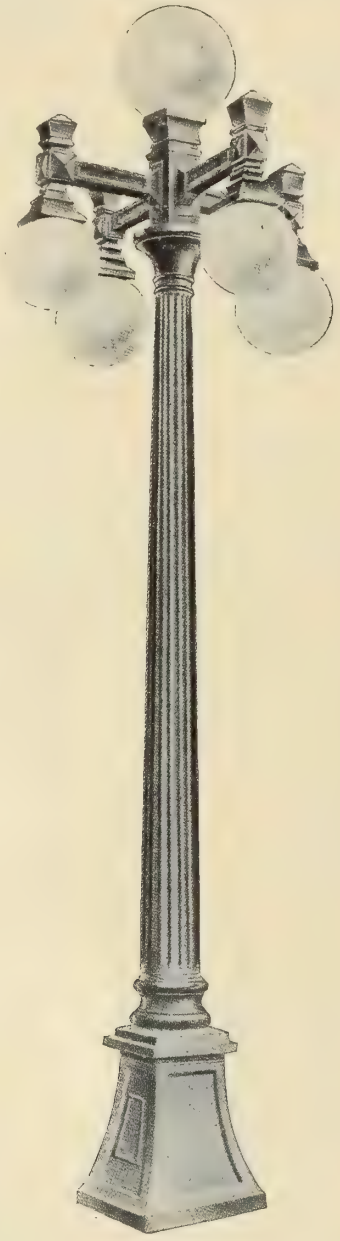
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The Steam Turbine, by Robert M. Neilson. Published in 1903 by Longmans, Green & Co., 294 pages, illustrated. Price $1.00.

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Electro-Dynamos, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company, 298 pages. Price 50c.

Electrical Engineering, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price $3.00.

Radiation Light & Illumination, by Steinmetz. Published in 1909 by McGraw Hill Publishing Company. Price $2.50.

Alternating Current Motors, by McAllister. Published in 1909 by McGraw Hill Publishing Co. Price $2.00.

Electric Motors, by Crocker & Ardendt. Published in 1910 by D. Van Nostrand & Company. Price $2.00.

Electric Motors, by Hobart. Published in 1910 by Whittaker & Company. Price $3.00.

Direct & Alternating Current Manual, by Bedell. Published in 1911 by D. Van Nostrand & Company. Price $1.00.

Short Course in Testing Machinery, by Morecroft and Hehrs. Published in 1911 by D. Van Nostrand & Company. Price $1.

Solenoids, by Underhill. Published in 1910 by D. Van Nostrand Company. Price $1.00.

The Watthour Meter, by Sheppard & Jones. Published in 1910 Technical Publishing Company. Price $1.00.

Electric Power Conductors, by Del Mar. Published in 1909 by D. Van Nostrand Company. Price $1.00.

Dynamo Electrical Machinery, by Sheldon & Hausman. Published in 1910 by D. Van Nostrand & Company. Price $1.50.

Electricity—Experimentally and Practically Applied, by Ashe. Published in 1910 by D. Van Nostrand & Co. Price $1.00.

The Dynamo (2 volumes), by Hawkins & Wallis. Published in 1909 by Whittaker & Company. Price $4.00.

Hydro-electric Developments and Engineering, by Koester. Published in 1909 by D. Van Nostrand & Company. Price $4.00.

Electric Meters, by Jansky. Published in 1913 by McGraw Hill Publishing Company. Price $2.00.

Steam Turbines, by Kennedy. Published in 1910 by Whittaker & Company. Price $1.00.

Transmission Line Formulas, by Dwight. Published in 1913 by D. Van Nostrand Company. Price $1.50.

Alternating Current Machinery, by Barr & Archibald. Published in 1910 by Whittaker & Company. Price $2.00.

Electrical Machine Design, by Gray. Published in 1913 by McGraw Hill Publishing Company. Price $3.00.

Dynamo-Electric Machinery, by Francis B. Crocker, E.M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Telephone Law, by A. H. McMillan. Published in 1908 by McGraw Publishing Company. 332 pages. Price $1.50.

Practical Methods of Electro-Chemistry, by F. M. Perkin, Ph.D. Published in 1905. 322 pages. Price $1.00.

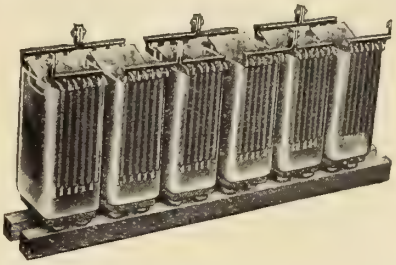
Treatise on Thermodynamics, by Dr. Max. Planck. Published in 1903. 272 pages. Price $1.00.

Text-Book of Electrochemistry, by Svante Arrhenius. Published in 1902. 344 pages, illustrated. Price $1.00.

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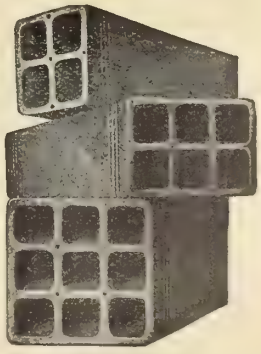
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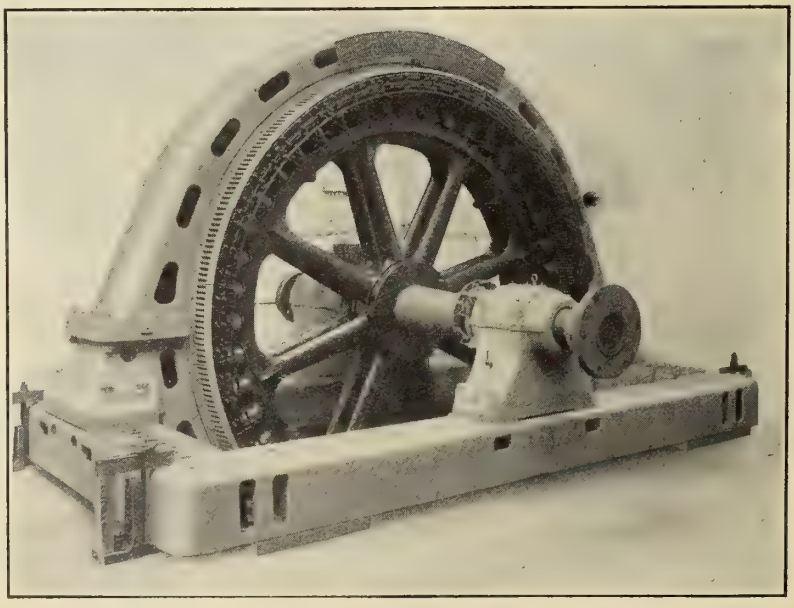


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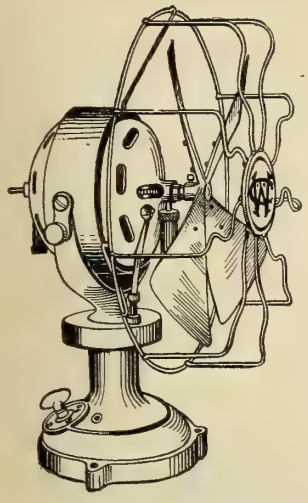
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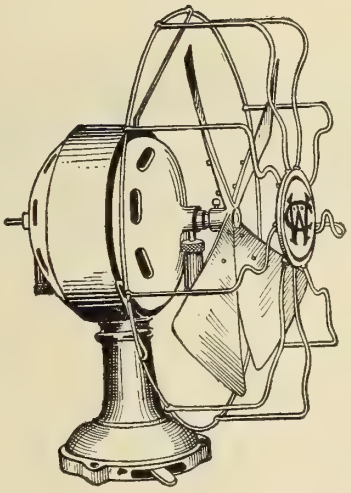
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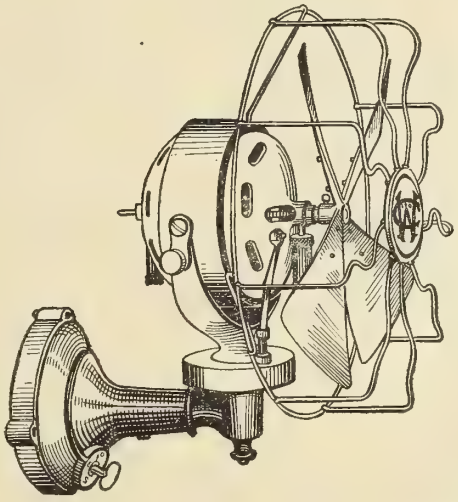


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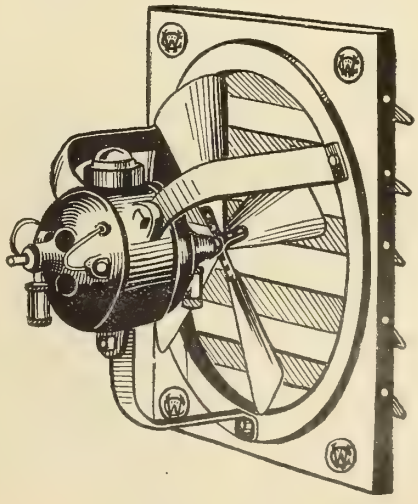


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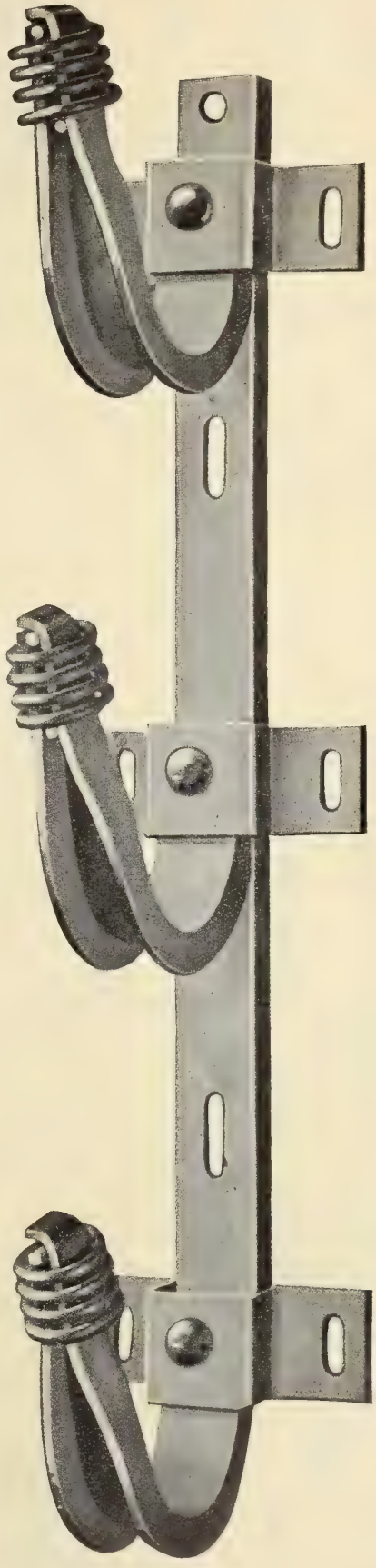
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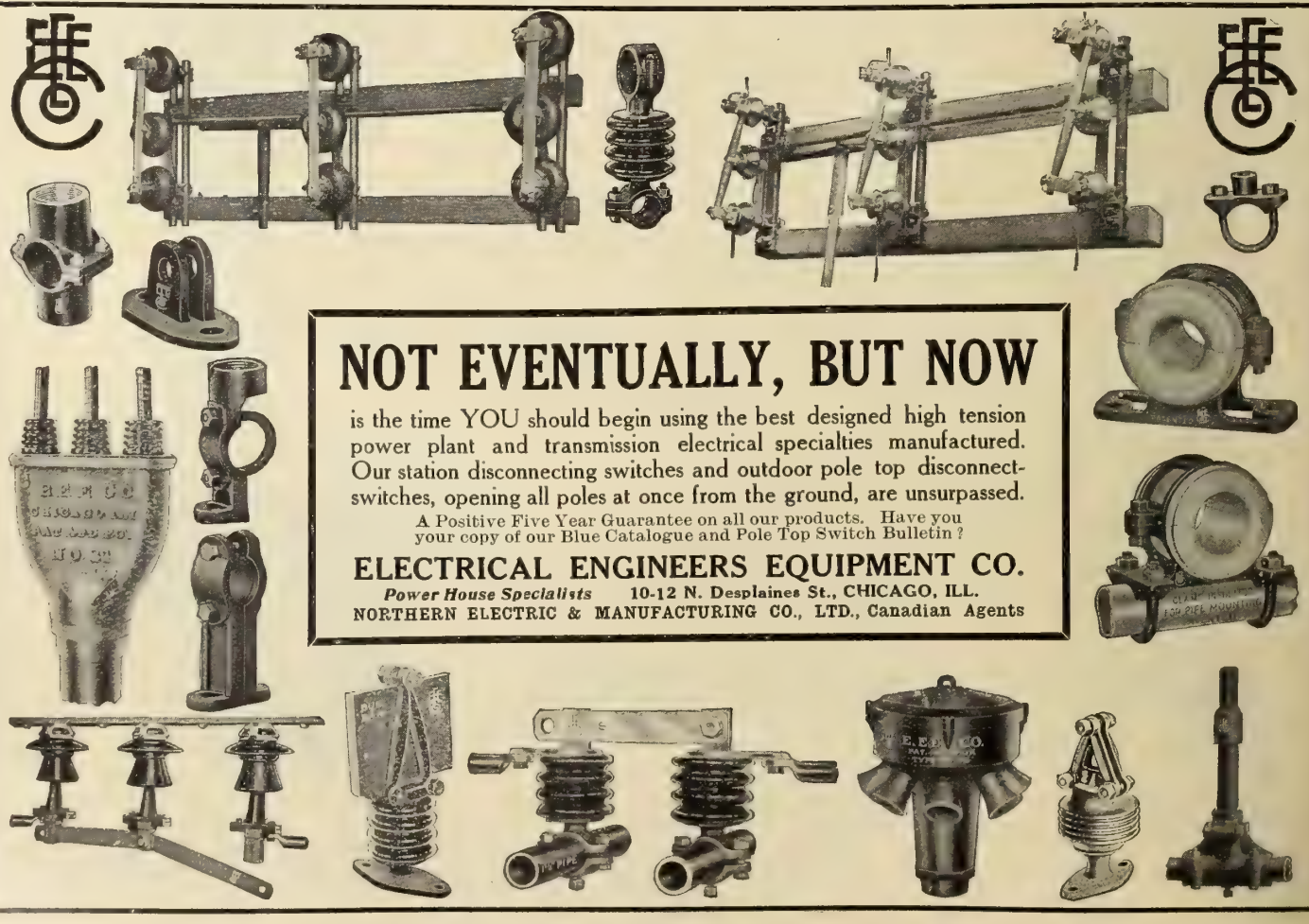
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Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY

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Vol. 22 Toronto, August 15, 1913 No. 16

Isolated Plants as Off-Peak Load

In spite of all the convincing arguments against the installation of isolated plants where central station service is available the number of these plants continues to increase at a very fair rate. While we believe these installations often represent errors in judgment when initial cost, depreciation, operation, valuable floor space, continuity of service and all the other little contingencies are reckoned, still there is the feeling of independence and freedom that often means more to a wealthy firm than dollars and cents. Much too, of course depends on the heating requirements which, generally speaking is the deciding factor.

In the past, central stations have looked on these small plants with disfavor but it is quite open to question if they cannot, under proper treatment, be made to work out as an actual advantage to the larger plants. The day is fast approaching when auxiliary generating equipment whether for steam, water or other prime mover, will be considered an essential to meet the modern ideal of continuity of service. It is quite conceivable that in a city of ordinary size there may be isolated plants with sufficient added capacities to take care of the more important part of the city load, especially as the central station trouble may arise at hours when the isolated plants may not be operating. Such a possibility, of course, presupposes an advanced stage of standardization and co-operation—a condition much to be desired and toward which we are plainly advancing.

But the isolated plant and the central station can co-operate, to the advantage of each, in another way and without delay. The chief reason for the installation of the majority of isolated plants is that boilers are required, anyway, for heating or other purposes. These however are rarely required during the summer months, and the owner of an isolated plant would naturally be willing to tie up to the city company during the summer if rates could be arranged satisfactorily. It also happens that this season is the light load period for the larger systems, when they perhaps can also afford to give somewhat lower rates. Looked at from this point of view the isolated plant can be made a most desirable customer in that it can be dropped during the heavy winter load period and taken on again during the summer. Under proper adjustment it looks as if any antagonism of the central stations towards their weaker rivals should give place to co-operation.

Steam Road Electrification

The recent announcement by the Canadian Pacific Railway Company that they will electrify immediately a section of their line in British Columbia, this to be followed by further electrification if this Canadian innovation proves a success, brings to mind once more the fact that there are a number of points in Canada where at the present time this very question of electrification is being discussed. Particularly in the Montreal district and from Montreal to Ottawa and possibly to Toronto there can be little doubt but that electrical equipment will be installed within the very near future.

As bearing on this question a recent paper by Mr. H. M. Hobart before the American Institute of Electrical Engineers brings out in a very thorough, interesting and lucid manner, the present-day situation with regard to the financial aspect of the electrification of the mountainous sections of Western North America. The paper points out that engineers in general have over-estimated the magnitude of the requirements of such a line as far as current consumption is concerned. It is stated as an example, that seventeen locomotives of 80 tons carrying 5,000,000 tons per year an average distance of 26 miles would require only 20,000,000 kw. hours and yet a 5,000 kw. motor generator often turns out this much energy in a year. On a 26-mile line only two substations would be required and four 1,000 kw. motor-generators and the only items of large expense would be the seventeen locomotives and the overhead wires, the track bonding and the negative feeders.

Considering the capacity of many of the large hydro-electric plants operating in the vicinity of the Rockies it is pointed out that the quantity of power required by the railway systems would therefore, be a matter of comparatively small importance. Therefore, the load factor, though generally low in railway service, is not of prime consideration. The fact, however, that synchronous motors have such a satisfactory effect on the regulation of the line is often lost sight of, but is of such importance that it may well be taken into consideration by the central station as it will justify a very low rate to the railway company.

Regarding economy of operation the paper points out that owing to the lighter weight of the electric locomotive the total weight of the train is better distributed. Also, there is more uniform torque as compared with the pulsating torque of the steam engine. It is also pointed out that in steam operation the efficiency from coal to drawbar is probably not higher than 2.32 per cent. as against 6.5 per cent. for electricity. The electric motor requires only one skilled engineer and a helper, simply as a safety factor; the steam locomotive requires three men. While the electric locomotives cost more they actually work out the cheapest in the end, considering the greater amount of work that can be done, the reduced maintenance charges and the very important item of less time lost for repairs. Specific figures on a 96 mile electrification are given in full. Extracts of Mr. Hobart's paper are given on other pages of this issue.

No Sign of Wreck

The current issue of the Bulletin of the National Electric Light Association, commenting on the discussion at the recent Canadian Electrical Association Convention with reference to continued affiliation or the formation of an association to include municipal plants, draws attention to the unusually large number of municipal plants in Canada, and takes occasion to refer in apparently unwarranted terms to the financial aspects of the Ontario Government distribution scheme, which it describes as "a financial wreck." We are unable to say what the source of the Bulletin's information may be, but presumably it is not different from the reports that have been made generally public, from which it would appear that there is at least room for argument. In the interpretation of figures over which there have been many different expressions of opinion we believe the Bulletin might have hesitated before making a statement laden with such damaging possibilities to the credit of the province concerned.

To all visible and physical appearance Ontario's system of distribution is admirably fulfilling the work for which it was installed. There is no question of its engineering efficiency or of its reasonable cost. Further, the total load has increased beyond the expectations of the promoters, and extensions at present going forward, at nearly every point of the system, have been forced on the Commission as a result of the co-operative demands of the sections served. The principle of municipal ownership may be all wrong but we think it only fair that the credit of our country should not be attacked until there is some more certain sign of the impending "wreckage."

Free Renewals of 100 Watts and Over

The custom of giving free carbon lamp renewals which was formerly a common practice with central stations before, and since, the advent of the tungsten, has not been extended to include the latter on account of the greater cost, smaller consumption and, often, shorter life of the metal filament type. With increasing improvements in manufacture, however, it is probable the custom will again become general as is indicated by the fact that some companies are already replacing, free of charge, tungsten units of 100 watts consumption and over and allowing a graded reduction on the smaller lamps.

In this connection the Electrical World of August 2 publishes an announcement of a number of the Edison Companies regarding reductions in prices of tungsten lamps. The New York Edison Company, The Commonwealth Edison Company of Chicago, The Edison Electric Illuminating Company of Brooklyn and others have placed all tungsten lamps of 100 watt rating and larger on a free renewal basis. The Brooklyn Edison Company also sell 10, 15, 25, 40 and 60 watt lamps whether plain or frosted at the uniform price of 20c. The Detroit Edison Company, following a similar policy, have made arrangements with local firms handling tungsten lamps to renew all the lower sizes for their customers at a uniform rate of 30c. The New York Edison Company and the United Electric Light & Power Company have adopted a graded scale of prices in which the smaller lamp has the higher price, the schedule being as follows: 10 watt lamps, 28c; 15 watt lamp, 25c; 25 watt lamp, 18c; 40 watt lamp, 16c; 60 watt lamp, 14c. For frosted lamps an extra charge of 2c is made. The Buffalo General Electric Company sells clear bulb tungstens rated 25 to 40 watts for 30c, and other sizes as follows: 60 watt, 35c; 100 watt, 65c; 150 watt, 95c; 250 watt, $1.60; 400 watt, $2.90 and 500 watt, $3.20. Reductions have also been placed in effect in Philadelphia, St. Louis, Boston, Minneapolis and Cincinnati. The Hartford Electric Light Company, some time ago placed tungsten lamps of 60 watt rating and over on a free renewal basis.

Another 9,000 h.p. for Rossland

The unique position occupied by the Canadian General Electric Company, Limited, in the design and construction of hydro-electric power machinery is well shown in the contract recently awarded by the West Kootenay Power and Light Company of Rossland, B.C. In order to increase the capacity of their plant the latter company decided upon the addition of a 7,500 kv.a. water-wheel driven generator. The Canadian General Electric Company will build the generator while the contract for the water-wheel was placed with the subsidiary Canadian Allis-Chalmers, Limited. This water-wheel will have a capacity of 9,000 h.p. at 180 r.p.m. under a head of 70 ft. The contract therefore will be carried out practically by one firm who are thoroughly familiar with the design and construction of both the electric and hydraulic portions and with the conditions necessary for their successful operation as one unit.

It is understood that the increase in the generating capacity of the West Kootenay Power and Light Company has been undertaken in anticipation of the electrical requirements of the Canadian Pacific Railway Company who intend to electrify the line between Rossland and Castlegar. The contract for the electrification of this section of the railway was, it will be remembered, also awarded a short time ago to the Canadian General Electric Company.

Series of Large Plants

The secretary of the U. S. Department of Agriculture has just issued a permit to the Pacific Light and Power Corporation of Los Angeles, California, to construct and operate a series of power plants in the Sierra national forest. The company plans to build four power houses, two reservoirs, and twenty-five miles of cement-lined tunnels. On account of the magnitude of the construction work and the amount of power to be disposed of, the permit provides for construction extending over a period of twelve years. Under a temporary permit the company has already nearly completed the first step of this development, known as the "Big Creek Project." This work is being done by the Stone and Webster Engineering Corporation.

The ultimate development proposed is about 150,000 horse-power. The greater part of this power will be transmitted 240 miles into Los Angeles and vicinity and will probably be used in large part on further extensions of interurban railway systems. It is also expected that considerable quantities of this power will be utilized in pumping water for irrigation in the upper San Joaquin valley. The power will be transmitted over a double steel tower line strung with stranded aluminum cables and at a pressure of 150,000 volts, the highest yet attempted in commercial transmission.

This development of the Pacific Light and Power Corporation is one of several under way or projected upon national forest lands in California. Among these are the projects of the Great Western Power Company on the north fork of the Feather River where a reservoir of forty-three square miles is to be constructed and power plants with a capacity of about 350,000 horse-power is to be built. The Southern California Edison Company is planning for the development of four plants on the Kern River. The Pacific Gas and Electric Company is constructing on the South Yuba, one of the highest masonry dams in the world. The greatest water-power development in the history of the state is now under way and most of the plants proposed or being constructed will occupy national forest lands under permit from the secretary of Agriculture.



The storage battery fleet operated by the Municipality of the City of Calgary.

Electric Trucks in Calgary

The city of Calgary recently purchased 7 electric trucks comprising one 5-ton, two 3-ton, two 1-ton, and two 1,000 gallon sprinklers and flushers. The complete outfit is shown in one of the accompanying photographs and the sprinklers are shown in action in the other picture. It is difficult to imagine a scene that would speak more forcibly of the rapid development of the West and their progressive attitude in all the phases of modern business life. We are indebted to Commissioner A. G. Graves, of Calgary, for the photos and the gratifying information that "electrics" are proving entirely satisfactory in meeting municipal requirements.

In regard to mileage, Commissioner Graves states that they make from 40 to 45 miles per day with the one-ton trucks, without boosting them at noon. The three-ton truck that is used in the Stores Department is doing very good work, so far as mileage is concerned. It has recently been hauling 6,090 lbs. of cement a distance of about 3½ miles.



Two storage sprinklers in operation, Calgary.

Nearly half of this distance is on paved streets, but after this there is a 11½ per cent. grade of about 1,500 ft. in length, which is still in an unimproved state. Beyond this there is about one mile of mud roads. They have been getting about 39 miles per day out of this particular truck, under the above mentioned conditions, without boosting when the roads were in a dry condition. On the other hand, when the roads are wet and slippery, it is necessary, to get the above mentioned mileage, to boost the batteries during the noon hour. So far they are getting splendid results, and the Commissioner has no doubt but that the operative costs will be well below the estimate which was compiled at the time of purchase.

Radioactivity and the Age of the Earth

The heating effect of radium and the other radioactive substances has an important bearing upon the problem of the age of the earth. You know that there has been a long-standing controversy between physicists and geologists about this problem. There are two principal methods of getting an estimate of the earth's age by physical reasoning. One method is to calculate the time required for the sun to reach its present size by contraction from an infinite sphere, radiating the heat thus produced at the rate determined by measuring the heat received in unit time on unit surface of the earth. The other method is to calculate the time it would take the earth to reach its present temperature, or rather its present rate of increase in temperature (about 1 deg. cent. in 100 feet) downwards from the surface. These methods give as the limiting age of the earth something between twenty and sixty million years. Now this is altogether too short a time to satisfy geologists, who base their reasoning partly on the fossils found in the different geological strata, and partly on the salt content of the oceans, assuming this to have been brought there from the land.

Lord Kelvin was careful to state that his low estimate of the age of the earth depended on no other source of heat energy being found. We now know that there is another source of heat energy, and that is the heating effect of radioactive substances. Nearly all rocks found on and near the surface of the earth are radioactive. The amount of radium contained in the common rocks in different parts of the world varies between wide limits. Some have a radium content as low as $1.2/10^{13}$ grams of radium per gram of rock. But on the average, the surface rocks have a radium content of about $2/10^{12}$ grams of radium per gram of rock; they also contain about $6/10^{6}$ grams of uranium and $1.2/10^{5}$ grams of thorium per gram of rock. If it is assumed that these proportions hold throughout the earth, there would result, from the heating effect of radioactive substances alone, more than ten times the amount of heat that is necessary to account for the present temperature gradient of the earth. So it is probable that the interior of the earth contains far less radium than is indicated by the surface. As a result of the discoveries in radioactivity, physicists will now allow the geologists all the time they require for the earth to have reached its present state.

There is another interesting application of the study of radioactivity to geology. If the amount of helium in a mineral be measured, and it be assumed that all the helium is a result of radioactive disintegration, a minimum estimate of the age of the mineral can be determined. Such estimates lead to times varying from 200 million years to 1,600 million years.—(From a lecture on "Radioactivity" before the A. I. E. E., by E. P. Adams).

Equipment of the Windsor Hotel

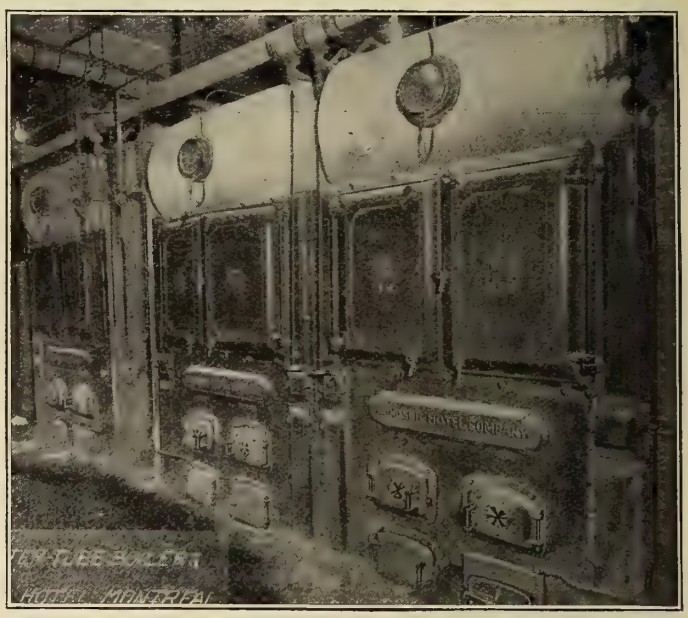
A New Isolated Plant in Montreal—Complete Electrical Equipment Throughout

The power equipment for the new Windsor Hotel, was designed and installed under the supervision of Mr. R. S. Kelsch, consulting engineer. This plant, which is in charge of Mr. Winkworth, chief engineer of the Windsor Hotel Company, is one of the most up-to-date isolated power plants in Canada. The main object of the plant is to furnish light and heat to the hotel and power for the various motors used in the laundry, for ventilating fans and in other parts of the hotel.

The steam equipment consists of three 200 h.p. Robb water tube boilers each with a heating surface of 2,143 square feet. Two of the boilers are set in a battery and one is installed singly. The boilers, which are built for 175 pounds working pressure, are equipped with cotton blowers for burning anthracite screenings. This type of boiler consists of two horizontal cross drums with headers which are connected by a main bank of inclined tubes. The drums are connected by two rows of horizontal tubes which complete the path of circulation for the water. At the extreme top, superheating tubes connect the drums so that the steam which is separated in the front drum is thoroughly dried and slightly superheated when it enters the rear drum from which it is piped to the engines.

In the engine room of this power plant there are installed three Robb vertical compound engines which are run non-condensing. Each engine is direct-connected to a 150 kw. electric generator made by the Canadian Westinghouse Company. These engines will operate the generators at 25 per cent. overload for two hours and 50 per cent. overload for one hour. With steam at 150 pounds pressure they will carry the normal load at a speed of 425 r.p.m. These engines are entirely enclosed so that working parts are protected from accident and there is no danger of oil being thrown about the engine room. Every revolving and sliding part is automatically lubricated by a system which consists of a pump and distributing pipes in which a pressure of from 10 to 20 pounds per square inch is maintained. Of the vertical type, these engines have many features which have been very successful in marine practice and modified for stationary practice enable the engines to maintain the speed desired for direct connection.

The electrical equipment had to take into account the fact that for some few years the hotel is under contract with the Montreal Light, Heat & Power Company for current so that electrical machinery will be used only as a stand-by during this period. This situation called for especial skill in design because the Power Company operates with alternating current generators which means that the direct current switches of the hotel must remain open except in the event

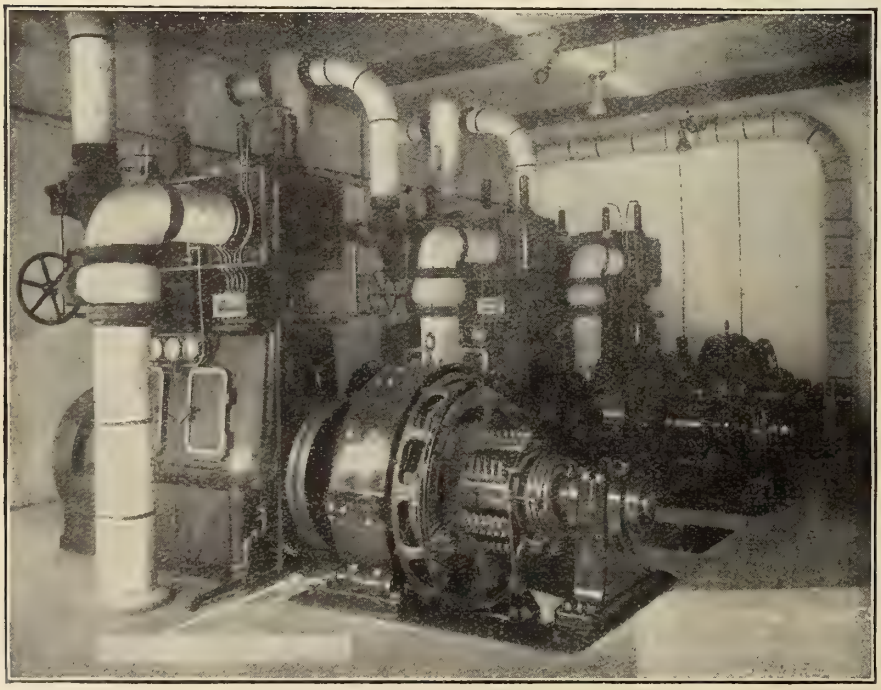


Windsor Hotel, Montreal– Boiler Room

of a shut down on the part of the Power Company. Should this happen the engines in the new power house will be started, the bus bars made alive therefrom and the circuit breakers and the switches on the feeders closed. Signal lamps indicate when the alternating current switches are closed and the direct current switches are open. These signals will enable the station operator to properly manipulate the switches so that the entire lighting system of the hotel will be transferred from the dead alternating current bus to the working direct current.

Electrical equipment for the laundry is interesting in that the individual drive is used throughout, and in addition the body ironers are electrically heated and all hand ironing is done electrically. The washing machines and extractors have individual motors, those for the washing machines being controlled from a master switchboard located in the engine room adjacent to the main switchboard. The circuit breakers and controllers are so arranged that the washing machine attendant simply presses the starting button, the machine making two revolutions in each direction until stopped by the pressing of the stop button.

The stopping and starting of the extractors is also accomplished by the push button method but in this case the attendant must keep the starting push button pressed until the extractor has attained almost full speed. This arrangement is necessary because of the possibility of the basket being out of balance. With this arrangement the attendant cannot leave or neglect the machine; he must stand by and observe what is happening until everything is safe.



Windsor Hotel, Montreal—Engines and Generators.

Motor-Converters—Theory, Design and Uses

A discussion of motor-converters as compared with motor-generators and rotary-converters—Efficiency and adaptability

In the conversion of alternating current to direct there are three common and distinct types of equipment—each of which is more and more coming to be recognized as covering its own special field—the motor-generator, the rotary or synchronous converter and the motor-converter.

For the more rugged work motor-generators have been the most favored with many electrical engineers, but their efficiency is lower than the other two types of apparatus and they are not reversible except where the motor is of the synchronous type. In construction this equipment consists of an a.c. motor which operates a d.c. generator on the same shaft. This equipment requires no transformers, the motor being operated direct from the distributing voltage.

A rotary converter consists of an a.c. motor and a d.c. generator combined in one machine. On the commutator side its performance is that of a d.c. generator while on the collector side it operates as an ordinary motor. With this equipment it is necessary to use transformers and it is found also that the inherent characteristics of the machine do not admit of its working satisfactorily on cycles above 30, or at most 40, unless the voltage is very low. The efficiency of the rotary converter is greater than that of the motor-generator.

The motor-converter is a more recent type of machine and in appearance practically duplicates the motor-generator. It consists of two machines, the revolving parts of which are mounted on the same shaft, but the input machine performs the function of a frequency converter while the output machine is similar to a rotary converter, that is the motor-converter is a rotary converter into which current is fed at the proper frequency by a frequency changer.

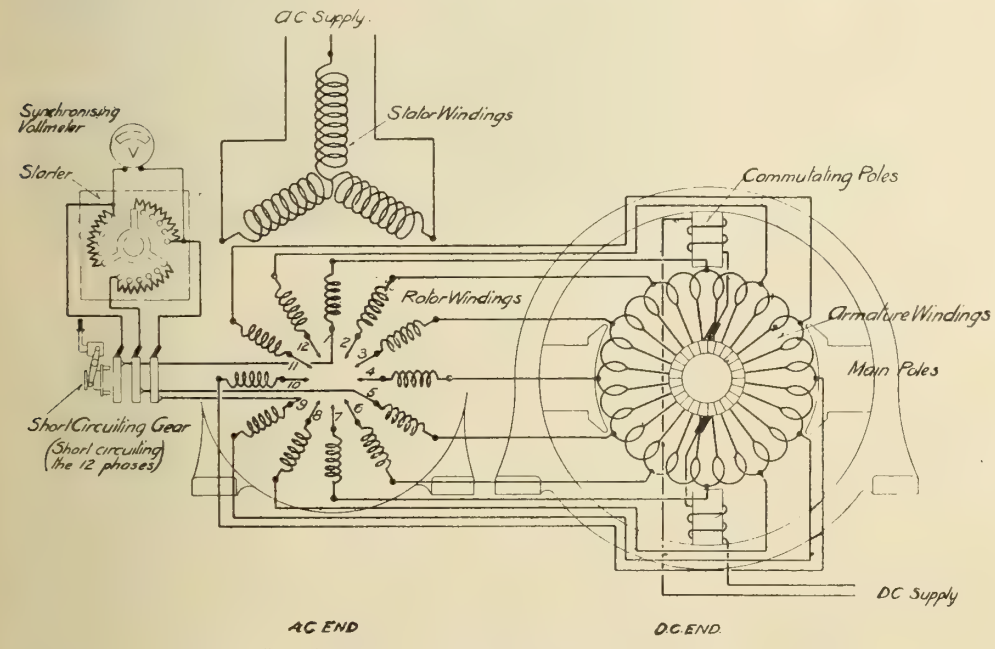


Fig. 1—Wiring diagram of motor-converter.

The advantages of the motor-converter for single phase service are particularly marked because the synchronous force of a single-phase set is practically as powerful as it is in a poly-phase converter, this being due to the fact that the rotor of a single-phase converter is also wound with twelve phases. Therefore the difference between the efficiency of the single-phase and a poly-phase converter is less than the corresponding difference in the case of synchronous converters or motor-generators. It is claimed that in comparison with a motor-generator, the motor-converter is more economical in first cost and 2.5 per cent. more efficient in operation. In comparison with a synchronous converter and the necessary bank of transformers the motor-converter is about as expensive in first cost and its efficiency about one per cent. less than the synchronous converter. The motor-converter however, is claimed to be better than the synchronous converter for frequencies above about 40-cycles on account of the improved commutation at the low frequency used in the d.c. portion of the machine. For frequencies below 40 the synchronous converter may therefore be considered preferable. It is claimed however, that even under the most favorable circumstances, the motor-converter affords much better control of the voltage of the energy delivered and requires less skilled attention.

The theory and design of the motor-converter can be better understood by reference to the accompanying diagram of connections of a standard unit. From this diagram (Fig. 1) it will be seen that a motor converter consists of an ordinary induction motor, the a.c. end, and a rotary converter, the d.c. end, rigidly coupled together, the rotor winding of the a.c. end and the armature winding of the d.c. end being connected in parallel. For the sake of simplicity, it may be assumed that the a.c. and d.c. ends have the same number of poles—in the case shown in the diagram, 2 poles, and, leaving out the question of starting, assume that the combined rotor and armature is running at a speed corresponding to half the primary frequency, or, in other words, that the rotor is running with 50 per cent. slip. It follows that the revolving field, induced in the rotor by the alternating current circuit, rotates, relatively to the rotor, at a speed corresponding to half the frequency of the supply circuit, and it thus induces in the rotor windings a series of e.m.f's which have also half the frequency of the supply circuit. Now the number of poles of the d.c. end is so arranged that the frequency of the currents induced in the armature winding at the above-mentioned speed is the same as the frequency of the rotor currents, and on account of this it is possible to connect the rotor and armature windings together (provided they each have a suitable number of turns) when their e.m.f's are equal and in phase. When this is done the speed remains constant, the two ends thus connected in tandem, behaving as a single synchronous machine.

As the rotor revolves at a speed corresponding to half the frequency of the supply circuit, half the electrical energy supplied to the a.c. end is converted into mechanical energy and transmitted by means of the shaft to the d.c. end, while the

other half of the energy supplied is transferred to the a.c. rotor winding and thereby to the d.c. armature winding in the form of electrical energy; thus the a.c. end operates half as motor and half as transformer, while the d.c. end operates half as continuous current generator and half as rotary converter. As the size of the a.c. end depends on the speed of the revolving field, and not on that of the rotor, it is theoretically, at the same speed, half as large as it would be if it converted the whole of the electrical input into mechanical energy. The d.c. end, running at a speed equal to half the frequency of supply, which is more advantageous with regard to commutation, is of smaller proportions than an ordinary continuous current generator or rotary converter for the same output and frequency.

The rotor is generally built with twelve phases, as the losses in converting half of the energy from a.c. to d.c. are then reduced to a practical minimum. A further increase in the number of phases has no material advantage.

The synchronising current taken at no-load is only the wattage necessary to cover the no-load losses, the absence of higher harmonics being due to the feature of the revolving field, and to the high reactance of the a.c. end.

From the foregoing it will be seen that, although the motor-converter is started like an ordinary induction motor-generator, yet when in service it runs synchronously with the main supply, being thus a synchronous converter, and as such has many of the important features of the synchronous motor-generator, in addition to the other valuable features already mentioned, which are unattainable with any other converting plant. In this connection it might be specially emphasised that a motor-converter can be used for power-factor correction at a certain predetermined load and voltage ratio.

Spare or standby motor-converters may also be used solely as power-factor improvers. When a motor-converter is to be used for this purpose it is run up and synchronised as usual on the a.c. side, but the d.c. side is left "open," and if the d.c. excitation is sufficiently increased by shunt regulation the a.c. side will supply leading wattless current. In this way it will be seen that motor-converters, which would otherwise be idle excepting at times of maximum load, can be used when desired as power factor improvers.

Standard motor converters for traction service are arranged to compound automatically from 500 volts at no load to 550 volts at full load. The power-factor is unity at about three-quarter load, and at larger loads the wattless current is leading, which has a favourable effect on the supply system. This feature is of special value where the central station supplies both traction and lighting systems, the primary voltage remaining steady in spite of fluctuating load upon the traction converters. The efficiency is noticeably high, especially at half and quarter loads. The freedom from liability to reversal of polarity, during starting up, and from "shorts" is of great advantage in traction installations. The actual power-factor of, say, a 500 kw. motor-converter, under service conditions, would vary between .96 and unity from half to full load.

Motor-converters used for lighting are shunt or compound wound according to the requirements, standard shunt machines being arranged to have about 5 per cent. voltage drop from no load to full load, with practically unity power-factor at all loads. The efficiency, especially at low loads, is remarkably high. Compound machines may be arranged with a rise or drop in voltage of as much as from 10 to 12 per cent. A large drop is, of course, sometimes desirable, as for instance when a battery "floating" on the bus bars is in use, this being common practice in sub-stations.

In many cases it is desirable that the converting plant shall be capable of supplying at different times a traction system at 500-550 volts and a lighting system at, say, from 440-480 volts. The motor-converter is eminently suitable for these conditions, the ordinary method of increasing the voltage by shunt regulation being available with motor-converters as with ordinary d.c. generators. The conditions, however, lead to increased dimensions and a somewhat lower power-factor. Several such motor-converter installations are in successful operation under conditions which necessitate a voltage regulation of as much as 40 per cent.

When motor-converters are used for three-wire supply they are arranged as shown in Fig. 2, from which it will be seen that the d.c. terminals are connected to the positive and negative mains in the usual way, the middle wire, which can be earthed if necessary, being connected through a suitable change-over switch to the star-point of the a.c. rotor winding. The brush gear and slip-rings at the a.c. ends of three wire converters are exactly the same as in ordinary two-wire converters, it being unnecessary to make them of heavier section —although they have to deal with the out-of-balance current —since, when the change-over switch is connected to the middle wire and the slip-rings short-circuited, the whole of the slip-rings together with their brush gear carry the out-of-balance current. A three-wire motor-converter automatically balances the voltage, and with an out-of-balance current of as much as 50 per cent. of the full load current, the variation between the two halves usually does not exceed 1 per cent. of the voltage between the outers. With 20 per cent. out-of-balance current the voltage variation would be within one-half per cent.

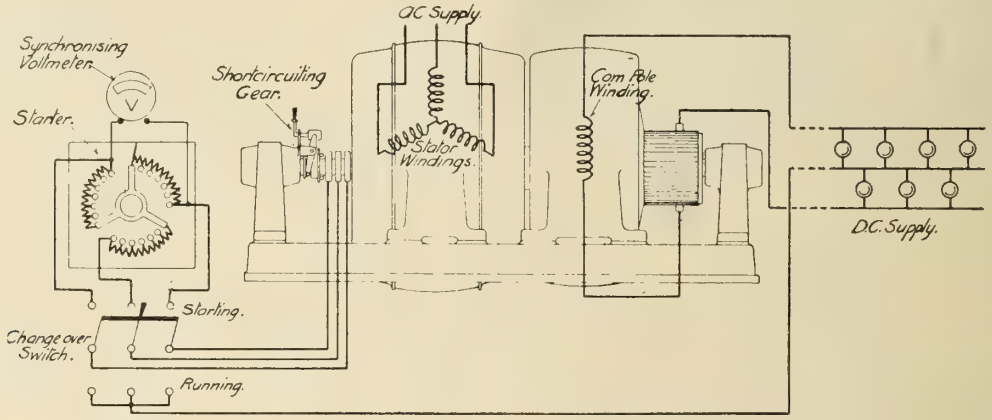


Fig. 2—Motor-converter used for 3-wire supply.

Obituary Item

Mr. Duncan N. Miller, superintendent of the Hamilton Street Railway Company was recently killed in an automobile accident. Mr. Miller was driving and apparently lost control of the car which ran over a steep embankment.

The Shipshaw Plant of Price Bros & Co.

Two Turbine Units 3300 h. p., horizontal type, operating 2250 kva. generators — 600 foot tunnel and large surge tank.

Some seventy years ago, Mr. Wm. Price established his first sawmill in Chicoutimi and gradually acquired extensive timber limits in the Province of Quebec. This industry throve and gradually branched out until today in the third generation, Price Bros. & Company, Limited, represent one of the largest paper industries in Canada. Their new modern 150-ton per day paper mill is located at Kenogami, near Jonquiere, on the Aux Sables river. From this river they derive power to drive the pulp grinders and also generate 6,000 h.p. of electrical energy for motive purposes in the mills.

Not having sufficient power on this river, they later purchased the water power rights at Shipshaw Falls, located on the Shipshaw river some four miles from Kenogami. The Shipshaw river is fed from Lake Onatchaway which in turn



Exterior power-house, Shipshaw Falls

is fed from lakes and rivers from Height of Land in Labrador. These falls are located some two miles up from the point where the Shipshaw empties into the Saguenay river, which latter place is practically sea level.

The minimum flow of water is 600 feet per second and the working head is 91 feet with possible 95 feet by using flashboards on dam.

Active work started on this plant in the latter part of July, 1912, and the plant was in operation within ten months —a record construction period when the many adverse conditions are considered.

The layout of this plant presented many engineering difficulties. Instead of the usual open canal, the water is led from the head gates at the dam into the surge tank (shown in one of the photos herewith), through a tunnel 600 feet long, having an inside diameter of 14 feet. The minimum thickness of the concrete wall of this tunnel is 16 in., reinforced circumferentially with sixty pound rails placed 3 feet apart.

The surge tank is 48 feet in diameter having solid concrete walls 18 in. thick, reinforced horizontally and vertically by 1-in. x 1-in. reinforcing steel placed 6 inches apart.

Leading from the surge tank are the openings for the three penstocks, two of which are already installed. Here it is that the water is directly controlled. At the entrance to each penstock a butterfly valve is installed which is electrically operated and directly controlled from the power house by means of push buttons.

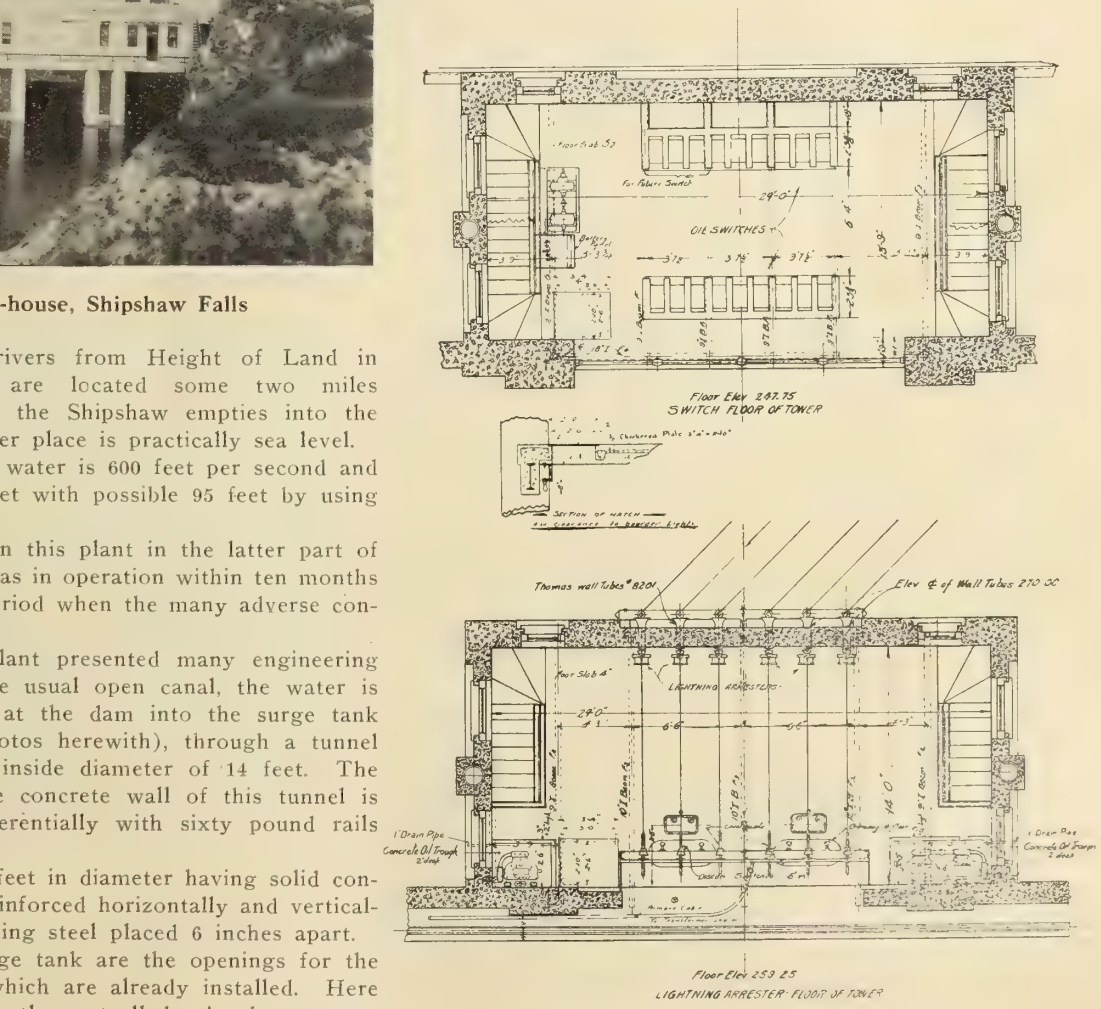
On the power house side of these valves, but still within the surge tank, there is installed, for each penstock, an air vent and inspection pipe 5 ft. by 2 ft., reaching vertically 14 feet above high water level.

Each penstock is 145 ft. long by 8 ft. diameter and built up of 3/8-in. boiler plate. Vent pipes and penstocks were installed by the John Inglis Company of Toronto.

The power house is 80 ft. long by 40 ft, wide, with foundations going down to bed rock. The power house is built entirely of concrete. An air duct ventilating chamber passes the full length of the generator foundations with openings into each generator pit. Provision is made for the high tension wiring by providing two galleries, while superintendent's office, machine shop room and lavatory are also provided.

A 35-ton electrically operated crane supplied by the Whiting Foundry and Equipment Company, runs the full length of the building.

Two turbines of the horizontal, double runner, central discharge, enclosed wheel case type of 3300 h.p. capacity, with 86 per cent. efficiency, are installed, as well as the



Switch and Lightning arrester floors

two smaller turbines for driving the d.c. exciters. The turbines and governors as well as the two butterfly gate valves and controlling apparatus therefor were manufactured and the installation superintended by the Allis-Chalmers-Bullock Company, of Montreal.

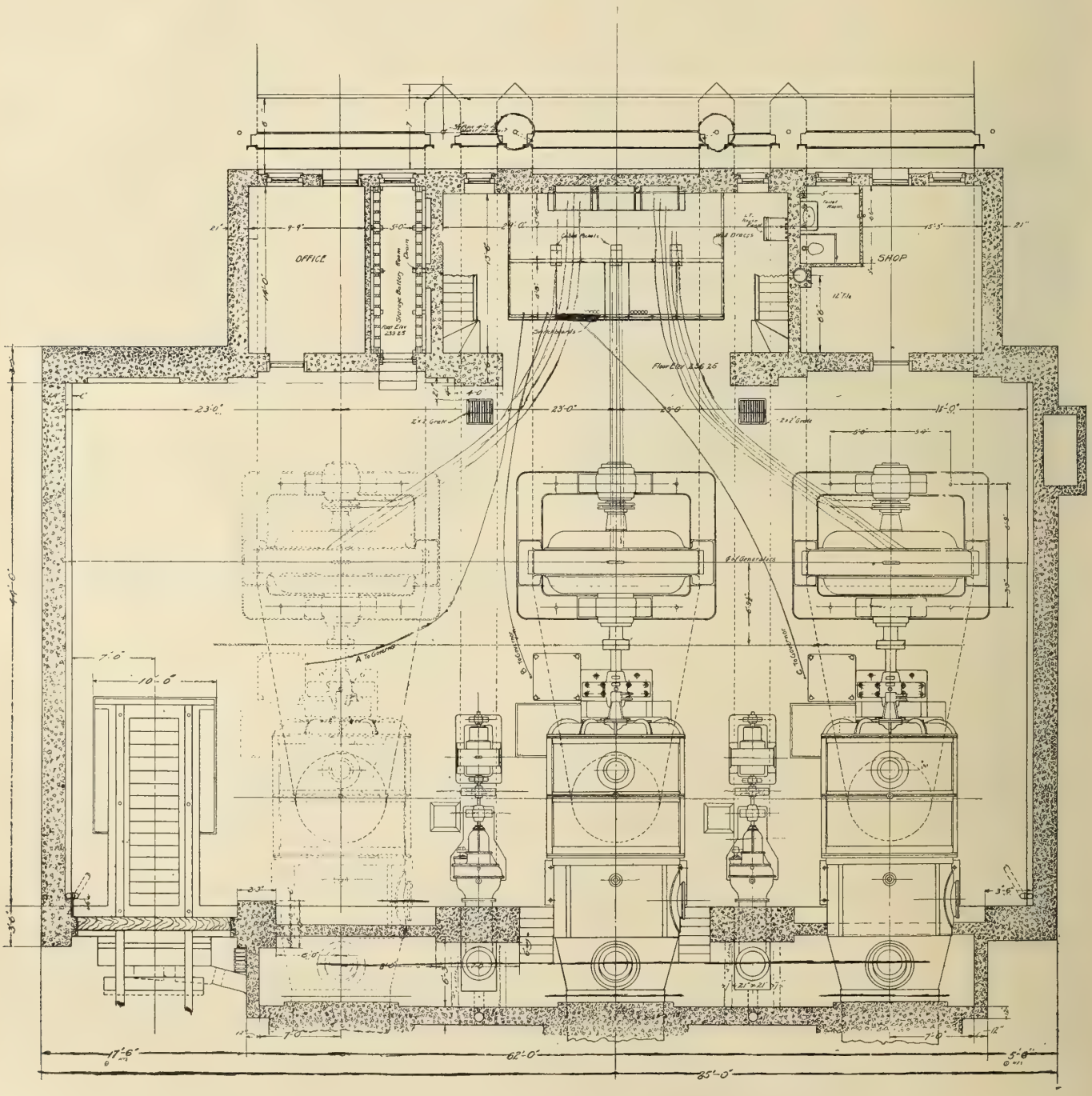
The electrical equipment consists of two a.c. generators rated at 2250 kv.a., 60 cycle, 300 r.p.m., 7,000 volt, giving an efficiency of 93.8 per cent. at full load and 80 per cent. p.f. The rotors of the generators are built up of 2-in. steel plates giving a fly-wheel effect of 400,000 pounds at radius of 1 foot. Excitation is provided for by two 120 kw., 900 r.p.m., 125 volt, d.c. exciters, either one of which is of sufficient capacity to excite the complete generating equipment of three units which will be the final total capacity of the station.

The switchboard is located in the bay level with the main floor and consists of nine panels of natural black, oil finished slate being designated as follows:— two line panels, one station lighting, two exciter, one Tirrill regulator, two for present installed generators and one blank panel for future generator, as well as two swinging end brackets for synchroscope and two a.c. voltmeters.

Provision is made for synchronizing this plant with the plant at Kenogami, where the generators are of the same voltage and characteristics as those installed here. To this end voltmeter receptacles and plugs together with synchronizing receptacles are installed in both power stations so that incoming voltage may be read and plants synchronized from either end.

On the first gallery are installed the five type E electrically operated, 3-phase oil circuit breakers controlled from their respective panels below. Here also are mounted the 7,000 volt busses, these being in duplicate with asbestos barriers between each phase. Six selector disconnecting switches, with asbestos barriers between each, are installed for use with each type E circuit breaker respectively.

A storage battery with normal rating of 80 amp. hours is installed to operate the oil switches and also, in case of emergency, to be used in opening or closing the main but-

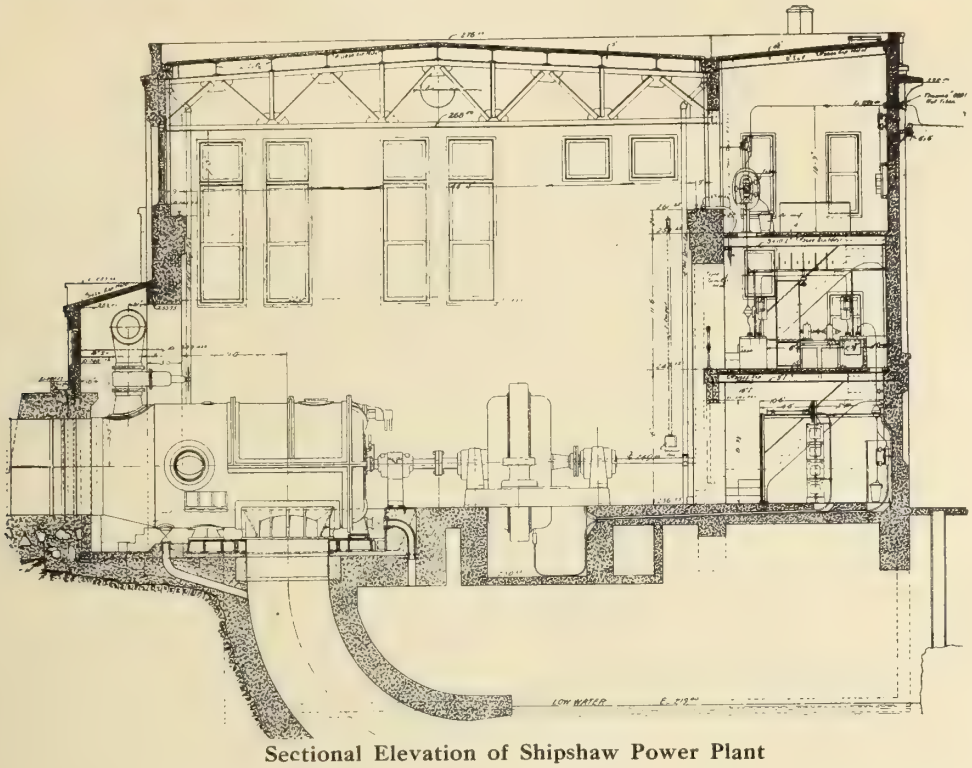


Floor plan of new power-house, Shipshaw Falls

terfly valves. This battery may be either charged from one of the exciters or from a small motor-generator set installed for the purpose.

On the top gallery are mounted the two sets of choke coils and multi-gap lightning arresters and here also provision is made for the outgoing line. Lead-covered cables work and provided with suitable reflectors. Heating of power house and surge tank is provided for by 220 volt electric heaters.

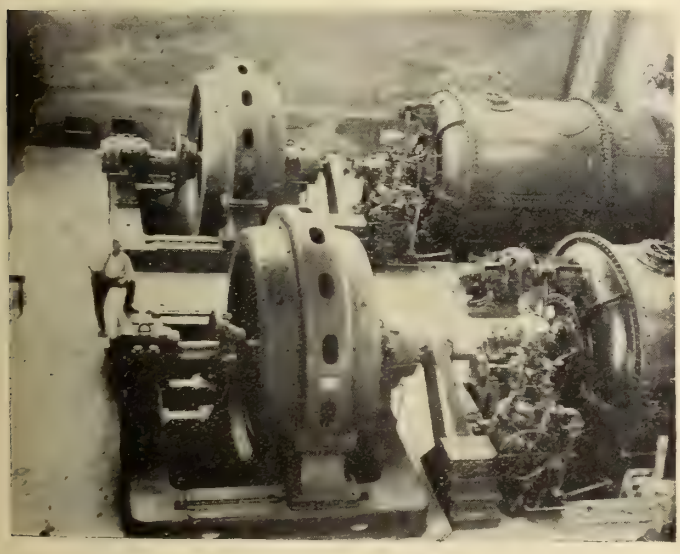
An electrically operated stop-log winch travels the full length of the dam and is supplied with power from the d.c. bus bars.



Sectional Elevation of Shipshaw Power Plant

with potheads are used for a.c. and d.c. generator leads as well as generator field leads. These pass through fibre ducts concealed in the floor. From the rear of the switchboard all high tension wiring is open work, number 0000, solid, soft drawn copper wire being used. The high tension wiring at rear of switchboard is protected by asbestos doors.

The transmission line consists of two three-phase lines of number 000 stranded copper wire mounted in the form of



Generators and Turbines—Shipshaw Falls

equilateral triangles on a single pole line. Two ground wires are strung overhead of each line respectively.

Ample power house lighting is provided by using 110 volt tungsten lamps, installed on the ceiling in open conduit

The complete electrical equipment was manufactured and installed by the Canadian Westinghouse Company of Hamilton.

Owing to the severe climatic conditions and heavy snowfall experienced in this northern locality, considerable difficulty was encountered in getting the machinery up from Chicoutimi, nine miles distant, into the power house. As it was, the manufacturers were obliged to ship all machinery completely knocked down and the machines were assembled on the job. Even then it was no uncommon sight to see an eight-ton piece on a sleigh, drawn by eight teams, stuck in a snow bank. This transportation was to a great extent solved when heavy four runner sleighs were adopted. The use of this latter type of sleigh would permit the outer runner cutting off the beaten track while the inside runner would support the load until firm track was regained.

Power for construction work was economically solved by transmitting electric power over the transmission lines from Kenogami at 7,000 volts. It was stepped down in a temporarily equipped substation and used to drive electric motors supplying power for air compressor, pumps, hoists, winches, stone crusher and cement mixers, as well as for lighting purposes.

Mr. R. S. Kelsch, Montreal, was consulting engineer for the entire installation and was represented on the ground by Mr. George Lewis as superintendent of construction. All work was done by day labor.

Work for, not against, the organization that pays you. The strength of an organization can scarcely surpass that of the individuals that make it. There are three principles that pay big dividends—punctuality, courtesy and industry.

Mountain-Grade Railway Electrification

A very complete discussion of the relative costs and operating expenses for steam and electric locomotives

By Mr. H. M. Hobart*

A keen interest is at present being taken in the electrification of mountain-grade divisions of main-line railways in the Western States of this country. In several concrete instances, careful estimates have demonstrated that the operating economies which can be effected by superseding with electric locomotives the steam locomotices on such railways are enormous, and are indeed, of such amounts as to defray in a very few years the initial outlay for substations, for feeders and contact-conductors, and for electric locomotives.

A chief factor contributing to this result relates to the very low cost at which the large hydro-electric supply companies in the West can profitably sell electricity for operating synchronous motors in substations. A considerable proportion of the present load of these hydro-electric undertakings consists in induction motors. The large lagging component of the current consumed by induction motors involves capital and operating costs which are very much in excess of the corresponding costs of supplying equal amounts of energy at unity power factor. Synchronous motors may with advantage be so operated as to consume a current with a large leading component. It often pays an electricity-supply company to go to the expense of purchasing and installing large synchronous motors for the express and exclusive purpose of running them idle and with high excitation, simply to neutralize the lagging component of the current consumed by the induction motor load. If the electricity-supply companies can find customers who will take upon themselves the expense of purchasing such synchronous motors and who will so operate them from the electricity-supply companies' system as to neutralize the undesirable lagging component, then they are spared the necessity of themselves incurring this capital outlay for improving the conditions on their system. Although the electricity-supply companies may not be able to satisfy themselves that they can equitably pay the railway companies for operating synchronous motors from their systems, nevertheless it will be seen that exceptionally low prices, satisfactory to both parties to the transaction, should readily be agreed upon. The equitable price in such a case should be arrived at on the basis of debiting the railway company with the value of the energy delivered to the substations and crediting the railway company with the value to the supply company of the leading current drawn from the system by the over-excitation of the synchronous motors in the substations.

The electricity-supply companies' traditional objection to a railway load of the sparse character associated with the operation of mountain-grade divisions, has, in the past, related to its very poor load factor. But when it is understood that these Western hydroelectric companies already have enormous loads connected to their systems, it will be seen that the fluctuations of a couple of thousand kilowatts, more or less, imposed by the intermittent operation of a few freight trains, is not a factor of consequence, especially since it does not affect the leading component of the current consumed by the synchronous motors.

Engineers have in the past usually erred in their ideas regarding the order of magnitude of a railway load. The present electricity-supply companies distributed about the country could often handle the load corresponding to relatively large railway undertakings without incurring the expense of any very considerable extensions of their generating and transmitting installations.

Let us illustrate this point by the case of the Butte, Anaconda and Pacific Railway, which is electrifying 90 miles of track with the 2400-volt system. The equipment comprises 15 freight locomotives and two passenger locomotives, each of these 17 locomotives weighing 80 tons. Although the undertaking involves transporting annually five million tons of ore over a distance of some 26 miles, the quantity of electricity which wil lbe consumed annually at the substations will only be of the order of less than 20 million kw.hr. A single 5000 kw. turbo-generator with a total weight (including steam-turbine, generator and their common base and bearings) of only some 115 tons, often turns out this quantity of electricity in the course of a year. Only two substations (26 miles apart) are required for the undertaking, and each substation contains only two motor-generator sets, each set having a rated capacity of 1,000 kw. and an ample overload capacity to carry 3,000 kw. for 5 minutes at intervals. The four motor-generator sets only aggregate a total weight of some (4 × 45) 180 tons. The only items of large consequence involved in the electrification of this undertaking are, on the one hand, the 17 locomotives, and, on the other hand, the provision of the overhead contact line, the track bonding and the positive and negative feeders.

Weight Distribution

Trailing loads of 3,400 tons[1] will be hauled by two of these 80-ton locomotives (operating as a single machine) from Butte to Anaconda over a route with a maximum grade of 0.3 per cent. For such a case we no longer have the condition which, as we have seen, so greatly affects the economy of the express-passenger proposition, namely, that the weight and friction of the locomotive constitute considerable percentages of the weight and friction of the entire train. Taking the friction of the trailing load (with reasonable allowance for curves), at 4 pounds per ton, the draw-bar-pull on a 0.3 per cent. grade amounts to

$$(0.3 \times 20 + 4) \times 3{,}400 = 34{,}000 \text{ lb.}$$

If the corresponding speed is 14 miles per hour, the power at the draw-bar is

$$\frac{14 \times 5{,}280 \times 34{,}000}{60 \times 33{,}000} = 1{,}270 \text{ h.p.}$$

Under such conditions the input to the locomotives is about

$$\frac{3{,}560 \times 1{,}270 \times 0.746}{3{,}400 \times 0.87} = 1{,}140 \text{ kw.}$$

At 2,400 volts, this corresponds to a current of about

$$\frac{1{,}140{,}000}{2{,}400} = 480 \text{ amperes}$$

or 240 amperes per locomotive. Considerably greater currents will be drawn from the line when starting and accelerating. When returning empty, the trailing load of some 1,000 tons must be drawn up maximum grade of one per cent. The tractive effort for the empty cars will be 8 lb. per ton and the draw bar pull will then be

*Extracted from a paper before the A.I.E.E.

[1]Many trains will be so much lighter as to require the use of only one 80-ton locomotive. Single locomotives will also be employed in the yards and at various points of the system as switchers and pushers.

$$28 \times 1{,}000 = 28{,}000 \text{ lb.}$$

Obviously, even for the heavy freight service on this mountain division, the use of two of these 80-ton locomotives will give a very wide margin of excess capacity. Each 80-ton locomotive will develop continuously a tractive effort of 25,000 lb. at 15 miles per hour. For the 160-ton combination this corresponds to a continuously sustained draw bar output of

$$\frac{15 \times 5{,}280 \times 2 \times 25{,}000}{60 \times 33{,}000} = 2{,}000 \text{ h.p.}$$

On a level track, higher speeds will be available. At starting, the 160-ton combination will provide a tractive effort of

$$160 \times 2{,}000 \times 0.25 = 80{,}000 \text{ lb.}$$

for a 25 per cent. coefficient of adhesion

or $160 \times 2{,}000 \times 0.30 = 96{,}000$ lb.

for a 30 per cent. coefficient of adhesion.

This tractive effort can also be provided by a Mallet locomotive with 160 tons on drivers. The engine and tender will, however, weigh some 250 tons and the weight on each of the six driven axles amounts to

$$\frac{160 \times 2{,}000}{6} = 53{,}500 \text{ lb.}$$

as against a weight of only

$$\frac{160 \times 2{,}000}{8} = 40{,}000 \text{ lb.}$$

on each of the eight driven axles of the electric locomotive. Obviously on the single score of the distribution of weight, the track conditions are distinctly less severe with the electrical alternative. There is also the important advantage, in the case of the electric locomotive, that the torque is uniform and in striking contrast with the pulsating torque of the steam locomotive.

But the essential contrast as regards relative capacities is brought to light when we state that the Mallett locomotive, when burning lignite of a calorific value of some 11,000 B.t.u per pound, can, when exerting a drawbar pull of 60,000 lb., only maintain a sustained speed of some 6.5 miles per hour. Under these conditions the locomotive will be consuming about 7,500 lb. of coal per hour, and will be developing

$$\frac{6.5 \times 5{,}280 \times 60{,}000}{60 \times 33{,}000} = 1{,}040 \text{ drawbar h.p.}$$

If the 250-ton Mallet locomotive is hauling a 3,400-ton train, then the indicated horse-power will be about

$$\frac{3{,}650 \times 1{,}040}{3{,}400 \times 0.75} = 1{,}500 \text{ i.h.p.}$$

The calorific value of the lignite employed as fuel may also be expressed as

$$\frac{11{,}000}{2{,}545} = 4.32 \text{ h.p.-hr. per pound}$$

Thus the efficiency from the coal to the cylinders is

$$\frac{1{,}500 \times 100}{7{,}500 \times 4.32} = 4.63 \text{ per cent.}$$

This efficiency estimate is on the basis of a fuel consumption of

$$\frac{7{,}500}{1{,}500} = 5.00 \text{ lb. of lignite per i.h.p.-hr.}$$

The efficiency from the coal to the drawbar is

$$\frac{1{,}040}{1{,}500} \times 4.63 = 3.22 \text{ per cent.}$$

The coal consumption per drawbar h.p.-hr. is

$$\frac{4.63}{3.22} \times 5.00 = 7.20 \text{ lb. per drawbar h.p.-hr.}$$

When, however, we take into account the coal wastefully burned during the large part of the time during which the steam locomotive is standing still, we arrive (for mountain-grade freight service), at figures of the order of from 10 to 12 or more pounds of lignite burned per drawbar h.p.-hr. On the basis of 10 lb. per drawbar h.p.-hr. the efficiency from the coal to the drawbar works out at

$$\frac{7.20}{10} \times 3.22 = 2.32 \text{ per cent.}$$

Even when, as will usually be the case in the West, the electric proposition involves obtaining energy from hydro-electric undertakings, it is nevertheless instructive to give close attention to these efficiency and coal consumption figures, and to contrast them with the results which may be obtained with the equivalent electricity generating station in which coal fuel is employed. It has already been stated that in such a case, some 6.5 per cent. of the energy in the coal burned at the generating station is delivered at the rims of the drivers. We have now seen that for the freight service in question, an electric locomotive weighing 160 tons, when compared with a steam locomotive weighing with tender some 250 tons, yields at least as great a drawbar pull at starting, since with the same weight on drivers it replaces a pulsating torque with a constant torque. Furthermore it can develop this drawbar pull at 14 miles per hour as against less than half this speed for the steam locomotive.

Smaller Crew Necessary

The electric locomotive requires to be manned only by one engineer, although, as a precautionary measure, an assistant engineer accompanies him on the locomotive. But when, as in the instance we have considered, a Mallet is burning 7,500 lb. of coal per hour, it is considered that it is beyond the capacity of a single fireman, and for sustained efforts of this amount, two firemen should be provided. In other words, in order to work up to a consumption of 7,500 lb. of coal per hour (corresponding to a speed of 6.5 miles per hour with a drawbar pull of 60,000 lb. making 1,500 i.h.p.) two firemen are necessary if these conditions of speed and drawbar pull are sustained for considerable periods. Thus a crew of three men are required on the steam locomotive when only 1,500 i.h.p. are developed, while on the electric locomotive just one man is actually necessary (although two are provided for the reasons stated), even when the locomotive is developing over 2,000 h.p.

Finally, as regards capital outlay and maintenance. Electric locomotives with the axles driven through gears cost a matter of some $450 per ton and the outlay for repairs and maintenance runs to some 4 cents per mile per 100 tons of weight of locomotive. The outlay for repairs and maintenance of steam locomotives is about of the order of 10 cents per mile per 100 tons of weight and since steam locomotives are inherently incapable of the mileage per annum which can be obtained from electric locomotives, then notwithstanding that steam locomotives cost considerably less than half as much per ton of weight[2], the charges per locomotive-mile for repairs and maintenance, plus interest, taxes, insurance and amortization are inherently decidedly greater for the steam locomotive than for the electric locomotive. Electric railway engineers are satisfied that these are conservative ratios. That the values which will ultimately be estab-

[2]This ratio of costs is only in small part due to any inherently greater cost per ton in the case of electric locomotives. It is chiefly due to the fact that whereas several thousands of steam locomotives are built every year, there are not more than a matter of 1000 electric locomotives in existence, and only 100 to 200 are built annually. The number of steam locomotives in the United States, the United Kingdom, Germany and France aggregates over 100,000.

lished will be still more favorable to the electric locomotive will only slowly be demonstrated in practice, largely for the reason that conventional methods of operating railways have been so evolved as to conform with the properties and limitations of the steam locomotive. Emancipation from these limitations will not immediately be followed by a revolution in methods of operating railways. On the contrary, the electric locomotive will for some time to come be compelled to conform to the conventions of the past. Advantage will only gradually be taken of the electric locomotive's inherently greater capacity as regards speed (in the case of freight haulage) for a given drawbar pull. It will be some considerable time before methods will so be modified that, in virtue of its greater capacity for speed in freight haulage, and in virtue of freedom from the necessity of devoting a large percentage of time to overhauling it and taking it out of service for repairs[3], 50 per cent. or even 100 per cent. more mileage per annum will be obtained from the electric locomotive than has been found expedient with its steam predecessor. Most of the present overtime expenses will be eliminated with electric operation and this in itself will effect a large saving in crew expense.

Electrification of a 96-mile Division

Let us now consider the electrification of a link in a main-line railway, which consists in a mountain-grade division 96 miles long. At certain seasons of the year there is experienced at this link, a congestion of freight traffic of so severe a nature that it becomes necessary to divert to other routes of much greater length a large per centage of the available freight.[4] The division is single-tracked with 15 sidings at an average distance of six miles apart, thus dividing the 96 miles into sixteen sections of varying length but averaging six miles each. The character of the route is such that double-tracking would involve enormous expense. This is often the case on mountain-grade divisions.

The trains negotiate an altitude of 3,800 ft. in 48 miles and return to the original level in the remaining 48 miles. Thus the average gradient is

$$\frac{3{,}800 \times 100}{48 \times 5{,}280} = 1.5 \text{ per cent.}$$

The ruling gradient is 2.2 per cent. There are occasional 2.5 per cent. gradients but these are so short that they may be dealt with as "momentum gradients" and are not determinants in arriving at the correct powering of the trains.

It is proposed that electric locomotives shall carry over this division trains of weight ranging from 900 to 1,800 tons (exclusive of the weights of the locomotives), and that while ascending, the average speed between stops shall be 12 miles per hour. Where the grade is in excess of the average value of 1.5 per cent., the speed will be less than 12 miles per hour, and for the gradients of less than 1.5 per cent. the speed will be in excess of 12 miles per hour. The range of variation will, however, be only of the order of from 9 to 15 miles per hour.[5] Ascending trains will be operated over the main track, and the number of stops will be reduced to a minimum. Descending trains will be operated at slightly higher speeds in order that they may be out of the way in the sidings when the ascending train arrives. Obviously on the basis of an average speed of 12 miles per hour, the 96-mile journey would require 8 hours were the ascending train to make no stops. On this admittedly theoretical hypothesis, and with trains in each direction simultaneously occupying alternate sections between sidings, the 96-mile division could contain simultaneously 8 trains travelling in each direction (or a total of 16 trains), and trains could be sent into the division from each end of the division at the rate of one per hour. Thus there could be 24 trains passed over the division in each direction per day. This leads us to the (theoretically) limiting capacity of

$$48 \times 96 = 4{,}600 \text{ train-miles per day.}$$

In practice, however, after making reasonable allowances of unequal distances between sidings, variations in speed due to varying grades and curves, delays at the terminals of the 96-mile division, inevitable stops even of the ascending trains, and other causes for irregularity, the practical limit of the capacity of the division may be taken as of the order of

$$(0.75 \times 48) \times 96 = 36 \times 96 = 3{,}460 \text{ train-miles per day.}$$

This is on the basis that there shall be only $(36/2 =)$ 18 trains instead of 24 in each direction per day.

Traffic of this intensity will, however, occur only during 100 days in the year. For the remaining 265 days, the freight to be transported will require only the equivalent of twenty-four 900-ton trains per day, or twelve 900-ton trains in each direction, whereas for the 100 days of dense traffic, the 36 trains per day will each represent 1,800 tons behind the drawbar.

Thus there will be transported annually over the division a total tonnage behind the drawbar, amounting to $100 \times 36 \times 1{,}800 + 265 \times 24 \times 900$[6] $= 6{,}500{,}000 + 5{,}700{,}000 = 12{,}200{,}000$ tons, or $96 \times 12{,}200{,}000 = 1{,}170{,}000{,}000$ ton-miles.

Making reasonable allowance for the weight of the cars and for empty and lightly-loaded cars, we may take one-half of this load behind the drawbar as revenue tonnage. The paying load will thus amount to 6,100,000 tons per annum or $96 \times 6{,}100{,}000 = 585{,}000{,}000$ ton-miles.

On the basis of an average rate of 0.75 cent per ton-mile, the gross receipts amount to $585{,}000{,}000 \times 0.0075 =$ $4,390,000 per annum or $45,600 per mile of railway.[7]

The requirements of the railway as regards number and size of locomotives must be based on the seasons of dense traffic. On the ruling grade of 2.2 per cent., an 1,800-ton train will require a drawbar pull of $(2.2 \times 20 + 8) \times 1{,}800 = 94{,}000$ lb.

Adding a further 36 per cent. in order to have a safe margin for increased journal friction in cold weather, for adverse winds and for severe curves, we arrive at the value of $1.36 \times 94{,}000 = 128{,}000$ lb. as the drawbar pull which should be available when dealing with 1,800-ton trains on this division. Providing a locomotive at each end of the train then each of these two locomotives will require to have sufficient reserve capacity for exerting a draw bar pull, or push, of

$$\frac{128{,}000}{2} = 64{,}000 \text{ lb.}$$

On the basis of a coefficient of adhesion of 0.20, each locomotive must have a weight on drivers of

$$\frac{64{,}000}{0.20 \times 2{,}000} = 160 \text{ tons}$$

Thus so far as relates to the provision of the required tractive effort, the 160-ton Butte locomotives already described in this paper, are appropriate for use on this 96-mile mountain-grade division.

The drawbar pull, when accelerating from rest (at the rate of one-tenth of a mile per hour per second) on the aver-

[3]While a comparatively short run necessitates that the steam locomotive temporarily be withdrawn from service for several hours for adjustments, cleaning and other attentions, no such limitations obtain in the case of the electric locomotive. Moreover it can be arranged that the engineer and his assistant shall relieve one another at frequent intervals, thus maintaining their strength and alertness to a degree quite impossible for the engineer and fireman constituting the crew of a steam locomotive.

[4]While the extent of the freight congestion assumed in this example is doubtless extreme, the rapidly expanding freight business of the country is leading to conditions of this order of seriousness.

[5]A few passenger trains will be sent over the division every day. But to simplify the investigation, it will be assumed that these are taken into account by their equivalent in freight traffic.

[6]It is shown later that the 1800-ton trains will require two locomotives and the 900-ton trains, one locomotive, consequently the annual locomotive-mileage is equal to $96 \times 100 \times 36 \times 2 + 96 \times 265 \times 24 \times 1 = 690{,}000 + 610{,}000 = 1{,}300{,}000$.

[7]It is recognized that this is a high figure, but it is consistent with the hypothesis of a congested link in an extensive railway system.

age gradient or 1.5 per cent., will be $(1.5 \times 20 + 10 + 10) \times 1{,}800 = 90{,}000$ lb. of only 69 per cent. of the maximum drawbar pull (128,000 lb.), available with a coefficient of adhesion of 0.20. When desirable, an acceleration of over a quarter of a mile per hour per second may be imparted to an 1,800-ton train on the average grade.

When working the line to its utmost capacity (i.e., with a descending train in every other length between sidings and an ascending train in each intermediate length between sidings, each train having a weight, exclusive of locomotives, of 1,800 tons) there would be simultaneously traversing the division 16 trains and 32 locomotives. It has already been explained that practical limitations will cut this down, either as regards the number of trains simultaneously present in the division or as regards the maintenance of the journey speed of 12 miles per hour for the 96-mile run. The actual shortage will be due partly to each of these two factors. With due allowance for additional locomotives to be available in making up trains at the terminals before entering the 96-mile division, and for spare locomotives, there should be provided a total equipment of 48 locomotives of 160 tons each.[8] This total number of locomotives is determined upon to meet the requirements of the 100 days of dense traffic. A considerable percentage of the 48 locomotives will be in excess of the requirements of the remaining 265 days of the year and will be enforcedly idle.

When handling an 1,800-ton train at a speed of 12 miles per hour on a 1.5 per cent. grade, we have

$$\frac{12 \times 5{,}280 \times 90{,}000}{60 \times 33{,}000} = 2{,}880 \text{ h.p. at the drawbar}$$

This will be subdivided between the two 160-ton locomotives, and each will deliver 1,440 h.p. at the drawbar, or

$$\frac{900 + 160}{900} \times 1{,}440 = 1{,}700 \text{ h.p.}$$

at the rims of the drivers.

Each locomotive has eight motors (one on each of the eight driven axles); consequently the output per motor when ascending the 1.5 per cent. grade at 12 miles per hour, is $1{,}700/8 = 213$ h.p.

Since this output of 213 h.p. is the average load, the work is seen to be well within the capacity of the equipment on the Butte locomotives, for on these locomotives each motor has a continuous capacity of 250 h.p. when cooled by the forced circulation of air through it.

In making up an estimate of the total annual traffic, we have arrived at the figure af 12,200,000 tons as the weight behind the drawbar passing annually over the division. Since we employ a 160-ton locomotive for every 900 tons, we shall have

$$\frac{12{,}200{,}000}{900} = 13{,}600 \text{ locomotive-journeys}$$

over the division per annum,

or $$\frac{13{,}600}{48} = 284 \text{ journeys per locomotive.}$$

Thus as an average for each one of the 48 locomotives we have a performance of $96 \times 284 = 27{,}200$ miles per annum.[9]

This is not to be taken as indicating an average mileage of $27{,}200/12 = 2{,}260$ miles per locomotive for each of the 12 months in the year. On the contrary, during the months of heavy traffic this will be greatly exceeded and during the months of light traffic a considerable proportion of the locomotive equipment will be idle and the average mileage per month per locomotive will fall greatly below 2,260 miles.

At the speed of 12 miles per hour (96/12 =) 8 hours would be occupied by the journey, and each locomotive would spend $286 \times 8 = 2{,}288$ hours per annum on the 96-mile division. But what with the decreased speed due to delays and the large amount of time occupied at terminals in making up trains, each locomotive would be in service with its crew for $1.5 \times 2{,}288 = 3{,}440$ hours. On the basis of eight-hour shifts and two men per crew, and an average wage of $6.00[10] per day, the wages per locomotive amount to

$$\frac{3{,}440}{8} \times 2 \times 6.00 = \$5{,}150 \text{ per annum}$$

or $$\frac{515{,}000}{27200} = 18.9 \text{ cent. per locomotive-mile}$$

Repairs and maintenance per locomotive amount to $0.04 \times 1.6 \times 27{,}200 = \$1{,}740$ per annum or $4 \times 1.6 = 6.4$ cent per locomotive-mile.

On the rough basis of $450 per ton, we may take the price of each locomotive as $160 \times 450 = \$72{,}000$.

The 48 locomotives run to a total initial outlay of $48 \times 72{,}000 = \$3{,}460{,}000$.

Taking interest, taxes, insurance and amortization as aggregating 12.6 per cent. on the investment for locomotives, these charges for each locomotive amount to $72{,}000 \times 0.126 = \$9{,}060$ per annum.

(This is on the basis of interest at 5 per cent., taxes 1.5 per cent., insurance 1.5 per cent., and a life of 15 years).

Thus we have, per electric locomotive per annum

I.—Wages of loco- crews	$5,150
II.—Repairs and maintenance	1,740
III.—Interest, taxes, insurance, amortization	9,060
Total of above three items	$15,950

For the 48 locomotives, this comes to a total of

$$48 \times 15{,}950 = \$766{,}000.$$

Cost of Electric Energy

Now let us estimate the amount of electricity consumed by the locomotives. On the ascent, the power averages 2,880 h.p, at the drawbar or 3,400 h.p. from the motors.

The average consumption by the locomotives works out at

$$\frac{3{,}400 \times 0.746}{0.87} = 2{,}920 \text{ kw.}$$

During the ascent, electricity is drawn from the line only during (48/12 =) 4 hours, notwithstanding that the ascent is only accomplished in a greater time than this.

The energy consumed during the ascent is

$$4 \times 2{,}920 = 11{,}700 \text{ kw. hr.}$$

No return of energy to the line will be credited to the locomotives during the descent; on the contrary, an allowance of 500 kw. hr. will be made for occasional applications of power.

Energy consumed by locomotives during descent = 500 kw. hr.

Total consumption of energy by locomotives for 96-mile journey with 1,800-ton train,

$$11{,}700 + 500 = 12{,}200 \text{ kw. hr.}$$

[8]With the mean value of 28 locomotives (14 trains) simultaneously occupying the 96-mile section, there remains $(48 - 28) = 20$ locomotives. With four undergoing repairs, we have 16 available at terminii, 8 at each end. Since these locomotives are double-ended, there will be much less time occupied than with steam locomotives in making up trains in readiness to be sent into the division.

[9]In the footnote No. 6, we have already arrived at the figure of 1,300,000 locomotive-miles per annum. We have $1{,}300{,}000/48 = 27{,}200$ miles per locomotive per annum, thus checking the above result in the body of the text.

[10]The crew of each locomotive will consist of an engineer and his mate. The latter accompanies the engineer on general principles relating to safety in the event that the engineer should be incapacitated from any cause. The engineer will receive a higher wage than this average of $6.00 for the crew, and the mate will receive less than this average. The average figure of $6.00 is high when taken in connection with the schedules at present in force, but its employment in this comparison is consistent with the purpose to favor steam-locomotive methods at all points where the reasonableness of the assumptions could be questioned.

For the 900-ton trains, the consumption per journey will be

$$\frac{12,200}{2} = 6,100 \text{ kw.-hr.}$$

There are $100 \times 36 = 3,600$ journeys per annum with 1,800-ton trains and $265 \times 24 = 6,360$ journeys per annum with 900-ton trains.

Thus the total consumption at the locomotive is

$$3,600 \times 12,200 + 6,360 \times 6,100 = 44,000,000 + 39,000,000 = 83,000,000 \text{ kw.-hr. per annum.}$$

Increasing this by 25 per cent. (i.e., by 21,000,000 kw.-hr.), to 104,000,000 kw.-hr. per annum to allow for terminal movements and for heating of locomotives and as a margin of safety, and taking at 0.93 the annual efficiency from the substations to the trains, we obtain for the output from the substations.

$$\frac{104}{0.93} = 112 \text{ million kw.-hr. per annum.}$$

The annual overall efficiency of the substations may be taken 78 per cent. Consequently the input to the substations is

$$\frac{112}{0.78} = 144 \text{ million kw.-hr. per annum.}$$

On the basis of a price as delivered to the substations, of 0.70 cent. per kw.-hr. the outlay for electricity is

$$144,000,000 \times 0.0070 = \$1,010,000 \text{ per annum.}$$

Per locomotive, this works out at

$$\frac{1,010,000}{48} = \$21,000$$

or

$$\frac{2,100,000}{27,200} = 78 \text{ cents per locomotive mile}$$

As to the overhead contact line, the rail bonding and the feeder copper, these will be covered liberally by an outlay of $8,500 per mile. Allowing for sidings, the total outlay will be $900,000.

Finally, there will be required four substations, each for an annual output of 28,000,000 kw.-hr.

On the basis of a load factor of 0.25, the maximum load on each substation will be

$$\frac{28,000,000}{8,750 \times 0.25} = 12,800 \text{ kw.}$$

The average load per substation will be only some

$$\frac{28,000,000}{8,750} = 3,200 \text{ kw.}$$

These substations will cost, complete, with step-down transformers and motor generators, some $160,000 per substation or $640,000 for the four substations.

Taking interest, maintenance, taxes, insurance, amortization, and labor for attendants, and linemen, as amounting to 16 per cent.[11] on this outlay of $(900,000 + 640,000) = \$1,540,000$ we arrive at a charge of

$$(0.16 \times 1,540,000 =) \$246,000 \text{ per annum}$$

or

$$\frac{246,000}{48} = \$5,130 \text{ per locomotive,}$$

or

$$\frac{513,000}{27,200} = 18.8 \text{ cents per locomotive mile.}$$

Thus for those annual outlays which are other for electric working than they are for steam working, we have:

	Per annum
Loco. wages, repairs and maintenance, interest taxes, insurance, amortization	$ 766,000
Electricity	1,010,000
Substations and distributing system	246,000
Total	$2,022,000

Now how does the case stand with steam? Let us assume that a 250-ton Mallet locomotive can handle a load of 600 tons behind the draw bar over this division with the same speed when in motion, as the 160-ton electric locomotive with its 900-ton load.[12] Then when, as at times of densest traffic, it is desired to carry freight in 1,800-ton trains, we shall require three 250-ton Mallets as against two 160-ton electric locomotives.

The average load at the drawbar, if equally subdivided amongst the three Mallets is

$$\frac{2,880}{3} = 960 \text{ h.p. per Mallet}$$

The drawbar pull is equal to

$$\frac{960 \times 33,000 \times 60}{12 \times 5,280} = 30,000 \text{ lb.}$$

This corresponds to an output from the cylinders of

$$\frac{(600 + 250) \times 960}{600 \times 0.75} = 1810 \text{ i.h.p.}$$

The fuel will be Western lignite of a calorific value of 11,000 B.t.u. (4.32 h.p.-hr.) per pound and the consumption will be five lb. per i.h.p.

The coal consumption for a speed of 12 miles per hr. and for 600 tons behind the drawbar, thus amounts to

$$\frac{1,810 \times 5}{12} = 755 \text{ lb. per locomotive-mile}$$

But this result is arrived at on the basis that there is no wasteful consumption during stops. Unlike the electric locomotive, however, several stops will be necessary for taking on water and for coaling, and the consumption during the ascent will be increased to at least 850 lb. per locomotive-mile, or

$$48 \times 850 = 40,800 \text{ lb. for the ascent.}$$

The descent will occupy some 5 to 7 hours. While the power required for propulsion will be negligible for most of the descent, nevertheless, steam must be maintained in the boilers, and also, owing to the high frictional-resistance of Mallet engines, power will be required for all grades materially lower than the average value of 1.5 per cent. Let us take the coal consumption as 400 lb. per hour, or $6 \times 400 = 2,400$ lb. for the 48-mile descent.

Thus the total coal consumption for the locomotive for the 96-mile journey, comes to

$$40,800 + 2,400 = 43,200 \text{ lb.}$$

This should be increased by 20 per cent. to cover the coal burned by the switching engines and also by the Mallets during terminal movements before entering and after leaving the 96-mile division, bringing the total to

$$1.20 \times 43,200 = 52,000 \text{ lb.}$$
$$= 26 \text{ tons}$$

This is an average of

[11] The criticism may be raised that this $246,000 should be considered in detail. To do so would only introduce uninteresting calculations. The item is relatively so small that it can consistently be dismissed without further comment than to point out that it includes an allowance of some $50,000 for wages of substation attendants, inspectors and linemen.

[12] This is crediting the Mallets with a higher speed for such loads than they can maintain. Nevertheless it is desired to err on the side of favoring the steam locomotive whenever there is room for divergence of opinion.

$$\frac{52{,}000}{96} = 540 \text{ lb. per locomotive-mile}$$

for the 96-mile journey.

At $2.40 per ton, we have a full cost of

$$\frac{540}{2{,}000} \times 240 = 65 \text{ cents per locomotive-mile}$$

Of course it is to be understood that the terminal operations are not executed by Mallets but by switching locomotives. But to simplify the calculations, the equivalent outlay is taken in terms of Mallets.

Attention must now be drawn to the consideration that with the delays inherent to steam locomotive operation, even on the favorable assumption that the speed with three 250-ton steam locomotives and an 1,800-ton train may, when running, be taken equal to the speed of two 160-ton electric locomotives and an 1,800-ton train, nevertheless, the running time for the 96-mile journey, (together with the increased time consumed in making up trains at terminals with single-ended and cumbersome steam switching engines as compared with double-ended and simple electric locomotives), will certainly be at least 50 per cent. greater. Thus for the 100 days of dense traffic when the division is worked to its utmost capacity, the train mileage is cut down to two-thirds of that obtained with electric operation. The limiting capacity of the line is thus reduced to

$$\frac{2}{3} \times 6{,}500{,}000 + 5{,}700{,}000 = 4{,}300{,}000 + 5{,}700{,}00$$

$$= 10{,}000{,}000 \text{ tons}$$

$$\text{or } 96 \times 10{,}000{,}000 = 960{,}000{,}000 \text{ ton-miles}$$

Again taking one-half as revenue load and crediting it with an average rate of 0.75 cent per ton-mile we ascertain the gross receipts to be

$$480{,}000{,}000 \times 0.0075 = \$3{,}600{,}000 \text{ per annum.}$$

$$\$37{,}500 \text{ per mile of railway.}$$

We have seen that for 600 tons behind the drawbar of each locomotive, the coal consumption to be debited to the entire journey works out at 540 lb. per locomotive mile.

This is

$$\frac{540}{300} = 1.80 \text{ lb. per revenue ton-mile,}$$

or

$$\frac{1.80}{2{,}000} \times 480{,}000{,}000 = 432{,}000 \text{ tons per annum}$$

At $2.40 per ton, the annual outlay for fuel amounts to

$$2.40 \times 432{,}000 = \$1{,}040{,}000.$$

The large amount of time required for cleaning, overhauling, repairing, adjusting and generally looking after the welfare of the steam locomotives renders it very liberal to credit each steam locomotive with an annual performance of

$$\frac{27{,}200}{1.50} = 18{,}100 \text{ miles}^{12}$$

as against each electric locomotive's 27,200 miles per annum.

On the other hand during the 265 days of light traffic it will be fair to estimate that one steam locomotive shall haul a 900-ton train at a slower speed, instead of hauling a 600-ton train at the higher speed at which an electric locomotive hauls a 900-ton train. Since during these 265 days the line is not worked up to its physical limitations, the disadvantage of this plan is chiefly confined to the greater outlay for wages per locomotive-mile. No greater outlay for wages on this score will however be debited against the steam locomotive in this comparison.

The total steam locomotive mileage during the 100 days of heavy traffic is

$$96 \times 100 \times 24 \times 3 = 690{,}000 \text{ miles.}$$

During the remaining 265 days the steam locomotive mileage amounts to

$$96 \times 265 \times 24 \times 1 = 610{,}000 \text{ miles.}$$

The total steam locomotive mileage per annum is thus

$$690{,}000 + 610{,}000 = 1{,}300{,}000$$

Consequently we must provide

$$\frac{1{,}300{,}000}{18{,}100} = 72 \text{ Mallet locomotives}$$

Each weighs 250 tons and may be taken as costing $45,000.

Thus for the outlay for locomotives we have

$$72 \times 45{,}000 = \$3{,}240{,}000.$$

Allowing, as with the electric locomotives, 12.6 per cent. to cover interest, taxes, insurance and amortization, we arrive at an annual charge of

$$0.126 \times 45{,}000 = \$5{,}660 \text{ per locomotive}$$

or

$$\frac{566{,}000}{18{,}100} = 31.3 \text{ cents per locomotive-mile}$$

Each of the 72 locomotives makes

$$\frac{1{,}300{,}000}{96 \times 72} = 188 \text{ journeys per annum.}$$

Were only (96/12 =) 8.0 hours occupied by the 96-mile journey, then each locomotive would spend

$$188 \times 8 = 1{,}504 \text{ hours per annum}$$

on the 96-mile division. But there must be taken into account the decreased speed due to delays during the journey and also the great amount of time consumed in making up trains at terminals. This handicaps operations with single-ended steam locomotives much more than with readily and promptly operated double-ended electric locomotives. It will be reasonable to assign to each steam locomotive an annual period of

$$2 \times 1{,}504 = 3{,}008 \text{ hours}$$

of service with its crew. The crew of the steam locomotive will consist of an engineer and a fireman working on eight hour shifts. On the basis of an average wage of $4.50 per day (the engineer receiving more, and the fireman less than this average), the outlay for wages for each steam locomotive, amounts to

$$\frac{3{,}008}{8} \times 2 \times 4.50 = \$3{,}380 \text{ per annum,}$$

or

$$\frac{338{,}000}{18{,}100} = 18.7 \text{ cent per locomotive-mile}$$

It will be noted that in estimating the wages for each Mallet it is assumed that only one firemen will be required. However, we have already seen that 40,800 lb. of coal will be burned during the 48-mile ascent. If this ascent is accomplished in 5 hours, the coal consumption amounts to 8,200 lb. per hour, if in 6 hours, 6,800 lb. per hour. It is often maintained that two firemen should be provided when it is required to fire such great hourly quantities of coal.

Repairs and maintenance per locomotive amount to

$$0.10 \times 2.5 \times 18{,}100 = \$4{,}250 \text{ per annum}$$

(This is on the basis of $10 \times 2.5 = 25$ cents per locomotive mile).

Thus per steam locomotive per annum we have

	Per annum
I.—Wage of locomotive crews	$3,380

[12] This works out at an average of 18,100/365 = 50 miles per day averaged over the entire year. This figure is higher than that for any Mallets of which I have records, when operating on severe mountain-grade divisions.

II.—Repairs and maintenance 4,250
III.—Interest, taxes, insurance, amortization 5,660

Total of above three items $13,290

For the 72 locomotives we have

$$72 \times 13{,}290 = \$956{,}000.$$

Bringing together the annual outlays which should be compared with those previously set forth as relating to equivalent operation by electricity we have

	Per annum
Locomotive wages, repairs, maintenance, interest, taxes, insurance and amortization	$ 956,000
Coal	1,040,000
	$1,996,000

But, whereas the electrical outlay of $2,022,000 per annum was associated with a revenue of $4,390,000 per annum leaving a difference of $2,368,000 per annum to be applied to the outlays common to both systems and to reserves, the corresponding steam outlay of $1,996,000 per annum is associated with the reduced revenue of only $3,600,000 per annum leaving a difference of only $1,604,000 to be applied to residual outlays and to reserves.

$$\frac{1{,}604{,}000}{2{,}368{,}000} = 0.68$$

Thus the residual amount with steam is only 68 per cent. of that with electricity.

It will be agreed that the correct basis for estimating the commercial results to accrue from electrical operation is to compare all those items which are affected by the use of electricity instead of steam. This is, however, inconsistent with the retention of the forms which have become customary in analyzing the results of steam operation. Consequently, as of probable interest, the locomotive operating expenses per locomotive mile are tabulated below.

	Operating expense in cents per locomotive mile. Steam locomotives	Electric locomotives
Fuel	65.0	0
Electricity	0	78.0
Repairs	20.0	5.6
Wages	18.7	18.9
Engine house expenses ..:	3.5	0
Lubricants	0.9	0.5
Stores	0.6	0.3
	108.7	103.3

These figures only apply to the particular 96-mile mountain division which has constituted the subject of our analysis and to the particular prices employed for coal ($2.40 per ton) and electricity (0.70 cent per kw.-hr.).

For the electric proposition there is an average load of 900 tons behind the drawbar for every electric locomotive. But from the data previously given we see that the average load behind the drawbar for the steam locomotive is only

$$\frac{960{,}000{,}000}{1{,}300{,}000} = 740 \text{ tons}$$

Consequently to reduce the locomotive operating costs to comparable terms let us take as a standard of reference 100 tons behind the drawbar. We then have steam locomotive operating costs per mile

$$= \frac{108.7}{7.40} = 14.7 \text{ cents per 100 tons behind drawbar.}$$

Electric locomotive operating costs

$$= \frac{10.3}{900} = 11.6 \text{ cents per 100 tons behind drawbar}$$

Let us look at the costs per locomotive-mile, per total train-mile and per 100-ton-miles behind the drawbar for the 1,800-ton train which we have more particularly investigated. This required three 250-ton Mallets or two 160-ton electric locomotives, bringing up the total train weights in the two cases to (3 × 250 + 1,800 =) 2,550 tons and (2 × 160 + 1,800 =) 2,120 tons respectively.

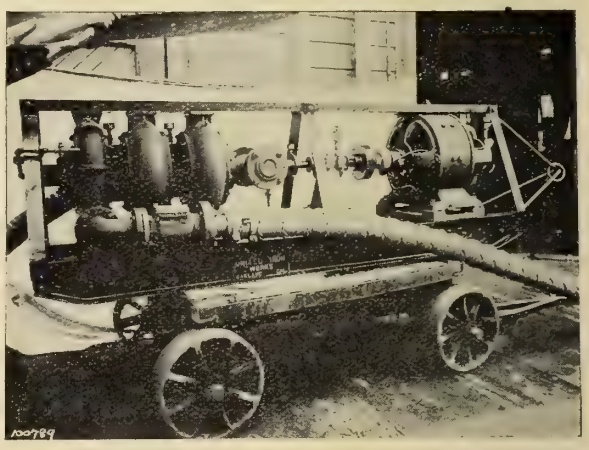
The results are set forth in the following table:

	Operating Expenses in Cents Per Mile					
	per steam locomotive	per electric locomotive	per steam train (3 locomotives)	per electric train (2 locomotives)	Steam Operation per 100 tons behind drawbar	Electric Operation per 100 tons behind drawbar
Fuel or electricity	65.0	78.0	195.0	156.0	10.8	8.7
Repairs	20.0	5.6	60.0	11.2	3.3	0.6
Wages.	18.7	18.9	56.1	37.8	3.1	2.1
Engine house expense	3.5	0	10.5	0	0.6	0
Lubricants	0.9	0.5	2.7	1.0	0.2	0.1
Stores.	0.6	0.3	1.8	0.6	0.1	0.1
Totals	108.7	103.3	326.1	206.6	18.1	11.6

Motor Driven Pump for Operation on Inclines

The accompanying illustration shows an interesting application of a motor-driven pump. It is designed for mine drainage and is to be used on inclines up to forty-five degrees from the horizontal.

The pump and motor are held together in a steel frame work with an eye at the end to which a cable or rope is attached for lowering the outfit down the incline. The lower part of the framework acts as a skid.



Motor driven pump for mines.

Special arrangements had to be made for oiling the motor. The lubricating device for the lower bearing is seen between the coupling and the bearing housing; it is fed with oil from the upper end by means of a pipe.

The pump is 4-inch, three-stage, and operates at heads up to 250 feet. The motor has a capacity of 30 h.p. and is of Westinghouse manufacture. Several pumps of this type are in operation and are said to be giving very satisfactory service.

A sub-station which will supply residents of the surrounding district with light and power has recently been erected by the Western Canada Power Company at the junction of the Pitt and Lillooet Rivers, near Port Coquitlam. A pole line to extend from the company's present line on the Lillooet River to the pump house on Pitt Meadows is at present under construction, the completion of which will place the large farming community located on Pitt Meadows, from the Fraser to the upper portion of the Pitt River, within reach of electric power in any required quantity.

THE SOCIETY FOR ELECTRICAL DEVELOPMENT

—Some Observations on the Underlying Principles—

By Mr. J. Robert Crouse

There are always some underlying, basis principles governing all change and progress—whether in the field of research, engineering, manufacturing or merchandising. These principles are of the same essential quality as the axioms in mathematics or refined statements of particular relations, such as C = E/R in our electrical business. Such principles do not depend for their truth or power upon minority or majority assent, and when once fairly stated, are assured of final acceptance since essential progress must be made in harmony with them.

Progress in our electrical business during thirty years (notwithstanding that less than 30 per cent. of the population is electrically served) has been one of the wonders of the world: its contribution to the comfort, happiness and efficiency of our modern life are so great that we wonder how a preceding generation did without it. We may justly feel proud of such a magnificent business which in every department of its development is so worthy of our best thought and effort.

The efforts of those engaged in the fields of research, engineering and manufacturing have shown the most marked results, since, while enjoying the stimulus of the friendly rivalry of other men and organizations, they have been free from the sort of competition which makes the accomplishment of useful results expensive and difficult. It is a matter of common observation that rapid progress has been made in discovery and research, in efficient engineering adaptation of discovery to practical manufacture, and improved products tending to better conditions of generation, construction and distributing systems.

However, in the field of selling and distribution we are challenged by the cold fact that no essential progress—meaning by this a decreasing ratio of sales expense to sales—has been generally accomplished. Not only this, but there is a prevailing opinion among the manufacturers, jobbers, dealers and contractors that the ratio of sales expense to sales tends to increase. The annual reports of some of the largest electrical manufacturers makes specific mention of this tendency as a fact in their operation. Among central stations this is doubtless true, since by common consent they are properly monopolistic for the best results and competitive only with other methods of furnishing service for light, heat, power and other useful purposes.

Our electrical business, technical in its very nature, has doubtless for that reason placed less emphasis in the past on aggressive selling and distributing effort—witness the fact that the first commercial papers in the National Electric Light Association appeared only so recently as 1905, and national advertising by individual companies began about 1907-1908.

It is estimated that the gross sales, ratio of sales expense and sales expense for 1912, in the electrical business, were approximately as indicated in the following table:

Branch of Business	Gross Sales 1912	Per Cent. ratio Sales expense to Sales	Sales Expense 1912
Central Stations	$400,000,000	5%	$20,000,000
Manufacturers & Jobbers .	300,000,000	15%	45,000,000
Dealers & Contractors ...	100,000,000	15%	15,000,000
Total	$800,000,000		80,000,000

This $80,000,000 of sales effort (which is equal to one-fifth of the gross sales of all the Central Stations) is incurred by approximately 5,000 central stations, 500 manufacturers, 200 jobbers, 5,000 dealers and contractors—a total of 10,700 organizations. It is of special importance to note that $60,000,000 of this $80,000,000 sales effort is incurred by the manufacturers, jobbers, dealers and contractors who operate under the complete competitive conditions, at a sales expense ratio of at least 15 per cent.—and tending to increase.

While this table and the above comments are broad generalizations, the reader is asked to check the principle and its application in his own particular case.

These facts in themselves are a challenge to commercial men, which cannot be avoided. They justify the most careful search for causes and investigation of plans for improvement.

Whatever minor causes may be contributory to this failure in more efficient merchandising, the major one, which experience and the facts disclose, is competition among these thousands of companies, resulting in expensive duplication of all kinds of sals efforts and failure to co-operate in a definite organized plan in those kinds of endeavor which supplement legitimate competition.

This competition is to a very great extent to secure the business held by others or of natural growth—which we may characterize as the existing market. A very large part of the selling effort is exerted on this existing market and dissipated in commercial friction and lost motion, with resulting decrease in its creative effect.

The age of business (in which someone has said we live to do business, instead of doing business to live, in the base sense) is in the order of social development the successor of the period when war—the extreme of competition—was the principal occupation. Business has inherited from this prototype many habits of enmity, antagonism and waste, which only the persistent cultivation of good fellowship, harmony and economy will gradually supplant. The most successful organizations which I have observed have given the greatest attention to the cultivation of harmony among their men, and the spirit of progressive, constructive effort. This same result must measurably follow similar conscious effort by an entire industry.

The Society for Electrical Development proposes a broad, common organization of our entire industry; central stations, manufacturers, jobbers, dealers and contractors (controlled by a balanced representation from each), through which a part of this $80,000,000 of unorganized and competitive sales effort can be more effectively exerted through organized and co-operative sales effort in promoting and popularizing electrical service. These plans to teach the public to "do it electrically"—many more than can at once be undertaken—have been worked out and endorsed as entirely practical by many prominent men in our business.

The society proposes at the start that a minimum of $200,000 or but one-fourth of one per cent. of this $80,000,000 of competitive sales expense, be co-operatively expended. The basis of subscription is for manufacturers, and central stations, one-fifteenth of one per cent. of gross sales, and one-twentieth of one per cent. for jobbers, dealers and contractors, amounting, for illustration, in the case of the former, to $66.66 per $100,000 of gross business, and in the latter to $50 per $100,000 of gross business—the subscription being on an annual basis. This means in the case of a company having a 15 per cent. sales expense account, but one-three-hundredth of their sales appropriations. There are few organizations which cannot locate competitive expenses of doubtful value equal to the society's subscription. While individual subscriptions are comparatively small and in no sense burdensome, yet general co-operation in the movement will make a fund $500,000 per annum available for progressive and aggressive market cultivation along these new lines.

This society creates the organization and the fund through which some of our dollars can co-operate with the good will of us all in broad effective activity for the expansion of the market, while we continue with the most of our dollars to compete for our fair share.

This plan means real progress in the direction of more efficient distribution of electrical service through joint culti-

vation of our common market—the great pre-occupied, incredulous, money-spending public—a result which our present systems neither accomplish nor promise ever to achieve on the old lines.

The plan presents a new kind of consolidation for sales efficiency through a better balance of competitive and co-operative effort to which the popular thought will not now nor in the future take exception.

The plan means that electrical men—identified with this most wonderful of all business—will demonstrate for themselves and by example for others—the true principles which underlie progress in more efficient sales distribution, through the creative cultivation of the market. The plan lends dignity to the art of selling—synonymous in the best sense with service—and marks a further point in the age now happily passing, when the selling spirit was symbolized in the economist's expression "caveat emptor"—"let the buyer beware."

CURRENT CONSUMPTION OF HEATING DEVICES

—— A Complete List of Capacities ——

Cost of heating by electricity and the question of whether this form of energy is capable of taking the place of coal or gas in ordinary commercial or household operations depends on many conditions peculiar to each locality, but the ultimate situation is continually growing more favorable to the use of electricity. Coal is becoming more scarce and more expensive, while electricity is being constantly reduced in price. Added to this there is the ever increasing efficiency and utility of electrically heated devices. When to these are also added the extra convenience of electricity, its cleanliness, its safety, its instant availability, its attractiveness and the superior quality of the work accomplished it is fair to assume that its use for heating purposes will become much more general in the very near future.

Already the progress that has been made is much greater than the average user of electricity is aware of and the number of appliances, household and otherwise, now being electrically operated is already very great. In this direction there does not seem to be the same chance of development, which must rather be along the line of increasing efficiency in the heating units and in improved design, which will result in a still smaller loss of heating energy.

Some very interesting figures have recently been prepared by Mr. H. O. Swoboda, consulting electrical engineer of the Westinghouse Electric and Manufacturing Company. Mr. Swoboda makes a comparison of the cost of electric heating with the cost of heating with coal or gas as shown in Table 1 herewith.

Table 1.—Comparative Cost of Heat Generated by Coal, Gas and Electricity

Coal—Develops at an average a heat of 12,000 B.t.u. per lb. The efficiency of coal burning heating apparatus averages about 10 per cent. Effective heat obtained from 1 lb. of coal = 1,200 B.t.u.; from 1 short ton of coal = 2,400,000 B.t.u.

Gas—Develops at an average a heat of 660 B.t.u. per cu. ft. The efficiency of gas burning heating apparatus averages about 20 per cent. Effective heat obtained from 1 cu. ft. of gas = 132 B.t.u.; from 1,000 cu. ft. gas = 132,000 B.t.u.

Electricity—Develops a heat of 3,413 B.t.u. per kw.hr. The efficiency of electrically heated apparatus averages about 80 per cent. Effective heat obtained from 1 kw.hr. = 2,730 B.t.u.

Based on these figures, the same amount of useful or effective heat is generated by 1 kw.hr. or 20 cu. ft. of gas or 2¼ lb. of coal. It follows that the prices at which electricity would have to be sold, to compete with coal and gas, if there would be no other advantage in using electrically generated heat are:—

Gas—Electricity		Coal—Electricity	
per 1,000 cu. ft.	per kw.hr.	per ton	per kw.hr.
$0.10—	0.2 cents	$1.50—	0.17 cents
0.20—	0.4 cents	2.00—	0.23 cents
0.30—	0.6 cents	2.50—	0.28 cents
0.40—	0.8 cents	3.00—	0.34 cents
0.50—	1.0 cents	3.50—	0.39 cents
0.60—	1.2 cents	4.00—	0.45 cents
0.70—	1.4 cents	4.50—	0.51 cents
0.80—	1.6 cents	5.00—	0.57 cents
0.90—	1.8 cents	5.50—	0.62 cents
1.00—	2.0 cents	6.00—	0.68 cents
1.25—	2.5 cents		
1.50—	3.1 cents		
1.75—	3.6 cents		

As showing the extent of the application of electricity to heating devices, Mr. Swoboda has also compiled the list given below in Table 2. This table shows the amount of maximum energy consumed by each appliance, which permits an approximate calculation of the cost of operating, and it also indicates that electrical heating appliances have been standardized for a great variety of domestic and industrial purposes. In fact, looking at this list, one is led to predict that this development will continue to go on and on and that electrical heating will become quite general in a not too distant future, just as the electric light has superseded the gas light and as the gas range has replaced the coal range, regardless of higher cost of operating.

Table 2.—Capacities of Electrical Heating Devices

The heating capacities, given in this table, are used by the leading American and European manufacturers and represent a fair average of standard practice. The figures indicate the maximum amount of energy required to raise the temperature to the desired point, less energy, of course, being required to maintain this temperature. When two figures are given, both are used, one for slow and one for quick action.

Air Heaters:—	
Convectors, smallest size, three heats	600 Watts
Convectors, largest standard size, three heats	18,000 "
Luminous radiators, smallest size, one bulb, single heat.	250 "
Luminous radiators, largest standard size, four bulbs, two heats	2,000 "
Quartzalite radiators, smallest size, two heats	600 "
Quartzalite radiators, largest standard size, two heats	1,600 "
Show window convectors, capacity per running yard, single heat	300 "
Street car heaters, smallest unit, three heats	250 "
Street car heaters, largest standard unit, three heats	450 "
Air humidifiers (bronchitis kettles)	600 "
Back rounders, for books, three heats	300 "
Beer vat driers, three heats	3,000 "
Boilers, double (cereal cookers), small size 3 pints, three heats	440 "
Boilers, double, largest standard size 6 quarts, three heats.	1,300 "
Boilers, hot water, heaters inside, smallest size 3 gallons, three heats	500 "
Boilers, hot water, heaters inside, largest standard size 100 gallons, three heats	14,000 "
Branding irons, single heat ... 150 to	660 "
Broilers, in oven shape, smallest size 16" x 14", two heats.	2,500 "
Broilers, largest standard size, 32"x 30", two heats	10,000 "
Broilers, open plates, smallest size 8" x 7¾", single heat.	660 "
Broilers, open plates, largest standard size 39"x19", two heats	6,400 "
Cauterizing instruments, without loss in controller 30 to	75 "
Celluloid heaters, three heats	900 "
Chafing dishes, smallest size 2 pints, three heats	250 "
Chafing dishes, largest standard size 3 pints, three heats.	500 "
Chocolate warmers, for maintaining chocolate in a fluid state for dipping, smallest size 12"x6½"x5", three heats.	220 "
Chocolate warmers, largest standard size, 14¼"x7⅝"x6", three heats	264 "
Cigar lighters, continuous service, single heat	25 "
Cigar lighters, intermittent service, single heat ... 75 to	200 "
Circulation water heaters, used in connection with boilers,	

smallest size, two heats	1,800	"
Circulation water heaters, largest standard size, two heats.	3,600	"
Coffee percolators, smallest size 1 pint, single heat 250 to	400	"
Coffee percolators, largest standard size 4 pints, three heats 350 to	500	"
Coffee percolators, restaurant size, 12 quarts, single heat	750	"
Coffee roasters, smallest size 2 to 3 lbs., three heats	800	"
Coffee roasters, largest standard size 8 to 10 lbs., three heats.	3,600	"
Coffee urns, smallest size 2 gallons, three heats	1,400	"
Coffee urns, largest standard size 5 gallons, three heats..	2,500	"
Combs, heated, single heat	50	"
Corn poppers, 1 quart, single heat	300	"
Cooking vessels with covers, smallest size 2 pints, three heats.	600	"
Cooking vessels, largest standard size, 26 gallons, three heats	7,500	"
Corset irons, 8½ lbs., two heats	500	"
Cosmetic heaters, single heat	25	"
Curling irons, self-containing, single heat	20	"
Curling irons, heater in separate tubing, single heat 60 to	400	"
Dentist's tools, such as root canal driers, gutta percha instruments, bleacher points, wax spatulas, hot air syringes without loss in controller 6 to	30	"
Disc stoves, smallest diameter 3", single heat 100 to	400	"
Disc stoves, largest standard diameter 20", three heats...	2,700	"
Distilling apparatus for ether, three heats	300	"
Distilling apparatus for water, smallest size 1 quart per hour, single heat	1,000	"
Distilling apparatus, largest standard size 8 quarts per hour, single heat	6,000	"
Domestic flat irons, smallest size 3 lbs., single heat 200 to	250	"
Domestic flat irons, largest standard size 9 lbs., single heat 400 to	675	"
Drag irons, smallest size 30 lbs., single heat	1,400	"
Drag irons, largest standard size 50 lbs., single heat...	1,600	"
Egg boilers, smallest size 1 egg, single heat	200	"
Egg boilers, largest standard size 6 eggs, three heats 360 to	600	"
Finishing (polishing) irons, smallest size 4 lbs., two heats 250 to	380	"
Finishing (polishing) irons, largest standard size 5½ lbs., two heats	450	"
Fireless cookers 150 to	660	"
Flask heaters, 8½" diameter, three heats	500	"
Flat plates, rectangular or oval, used as food warmers, griddle plates, laboratory plates, glue plates, smallest size 4x4", three heats	60	"
Flat plates, largest standard size 80x40", three heats	4,500	"
Foot warmers, smallest size 9"x10", single heat	50	"
Foot warmers, largest standard size 10x12", three heats	400	"
Frying pans, round, smallest diameter 4", single heat	300	"
Frying pans, largest standard diameter, 12", three heats 1,800 to	2,000	"
Frying pans, rectangular, with cover, smallest size 10x6½x5", three heats	1,000	"
Frying pans, rectangular, with cover, largest standard size 24x12x5", three heats	3,300	"
Furnaces for dentists, with controller	500	"
Furnaces for heat treatment of tool steels and other metallurgical work		
1,800 deg. F. maximum, smallest size	450	"
largest standard size	4,150	"
2,000 deg. F. maximum, smallest size	650	"
largest standard size	15,000	"
3,600 deg. F. maximum, smallest size	10,000	"
largest standard size	75,000	"
Furnace, Heroult 15-ton steel, with controller	1,500	kw.
Furnaces, vacuum type, for laboratory research work—		
5 cu. in. capacity, 5,600 deg. F. maximum	15	kw.
125 cu. in. capacity, 3,100 deg. F. maximum	60	kw.
Glove form heaters, single heat	50	Watts.
Glue cookers with circulation water heaters, smallest size 3 gallons, three heats	1,800	"
Glue cookers, largest standard size 25 gallons, three heats.	7,200	"
Glue pots with immersed heaters—		
smallest size ½ pint, three heats 150 to	330	"
largest standard size 5 gallons, three heats	2,500	"
Gold annealers for dentists with controller	400	"
Goose irons for tailors, smallest size 12 lbs. 600 to	770	"
Goose irons, largest standard size 25 lbs.	825	"
Hat brim irons, single heat	50	"
Hat form heaters, three heats	500	"
Hatters' irons, 9 to 15 lbs., two heats	450	"
Heating pads, smallest size 11x15", three heats	50	"
Heating pads, largest standard size 24x60", three heats..	400	"
Hot air blowers, smallest size, two heats	500	"
Hot air blowers, largest standard size, two heats	1,400	"
Hot water cups, smallest size ½ pint, single heat	150	"
Hot water cups, largest standard size 2 pints, single heat.	500	"
Hot water tea kettles, smallest size 1 pint, single heat 250 to	300	"
Hot water tea kettles, largest standard size 2 quarts, three heats	750	"
Hot water pitchers, smallest size 1 quart, single heat	600	"
Hot water pitchers, largest standard size 3 quarts, single heat 660 to	10,000	"
Hot water tanks for manufacturing purposes, smallest size 26 gallons, two heats	4,500	"
Hot water tanks, largest standard size 52 gallons, two heats	10,000	"
Immersion coils, smallest size 6½" diameter, three heats	440	"
Immersion coils, largest standard size 11" diam., three heats.	2,500	"
Immersion heaters, cylindrical type, smallest size 2¾" diameter, three heats	300	"
Immersion heaters, cylindrical type, largest standard size 20" diameter, three heats	10,000	"
Immersion disc heaters, smallest size 3" diameter, two heats	150	"
Immersion disc heaters, largest standard size 8" diameter, two heats	660	"
Immersion tubeheaters, smallest size, single heat	170	"
Immersion tube heaters, largest standard size, single heat.	660	"
Inhaling apparatus, smallest size ½ pint, singleheat	100	"
Inhaling apparatus, largest standard size 2½ pints, three heats	800	"
Instantaneous hot water heaters, smallest size ½ pint per minute, temperature increase 68 deg. F.	600	"
Instantaneous hot water heaters, largest standard size 10 quarts per minute, temperature increase 136 deg. F...	24,000	"
Ironing machine (mangles), smallest size 40" long, three heats	2,400	"
Ironing machine, largest standard size 80" long, three heats	6,400	"
Lace iron, single heat	70	"
Machine irons for tailors, with controllers, smallest size 12 lbs.	770	"
Machine irons for tailors, with controllers, largest standard size 18 lbs.	770	"
Melting pots for pitch, smallest size 12" diameter, 2½" deep, three heats	1,300	"
Melting pots for pitch, largest standard size 15" diameter, 2½" deep, three heats	1,600	"
Melting pots for sealing wax, paraffin, smallest size ¼ pint, single heat	80	"
Melting pots for sealing wax, paraffin, largest standard size 5 quarts, three heats	550	"
Melting pots for soft metal (lead alloys), smallest size 4 lbs., three heats	200	"
Melting pots for soft metal (lead alloys), largest standard size 50 lbs., three heats	1,500	"
Milk sterilizers for 8 bottles, three heats	700	"
Milk testing sets, single heat	600	"
Milk warmers for 8 ounce bottles 400 to	500	"
Oil tempering baths, smallest size 9 gallons, with controller 600 deg. F. max. temp.	6,000	"
Oil tempering baths, largest standard size 37 gallons, with controller 600 deg. F. max. temp.	20,000	"
Ovens for baking, roasting, drying, warming, enameling, smallest size 14x14x18", three heats	200	"
Ovens for baking, roasting, drying, warming, enameling, largest standard size 42x30x67", three heats	10,000	"
Potato cookers, smallest size 5 quarts, three heats	750	"
Potato cookers, largest standard size 10 quarts, three heats.	1,000	"
Potato steamers for hotels, smallest size 20 quarts, six heats	3,000	"
Potato steamers for hotels, largest standard size 50 quarts, six heats	4,500	"
Puff irons, smallest size 3x1¼", three heats	155	"
Puff irons, largest standard size 6x3½", three heats	400	"
Ranges for domestic and restaurant use, 2 to 6 persons..	4,000	"
Ranges for domestic and restaurant use, 6 to 12 persons..	5,500	"
Ranges for domestic and restaurant use, 12 to 20 persons..	7,500	"
Sand box heaters for trolley cars, single heat	100	"
Sealing wax heaters, hand tool style, single heat	75	"
Shoe irons, portable, single handle, six heats	100	"
Shoe irons, portable, double handle, six heats	210	"
Shoe relasting irons, portable, single heat	50	"
Shoe warmers, smallest size 4"x1¼"x½", single heat	20	"
Shoe warmers, largest standard size 8"x3"x1", single heat.	30	"
Sleeve irons, 3½ lbs., two heats	300	"
Soldering irons, smallest size 10 ounces, single heat	75	"
Soldering irons, largest standard size, 4½ lbs., single heat.	450	"
Steam sterilizers, small size 5 quarts, three heats	3,500	"
Steam sterilizers, large size 6 quarts, three heats	4,000	"
Sterilizers for surgical and dental instruments, smallest size 8"x3½"x2", three heats	350	"
Sterilizers for surgical and dental instruments, largest standard size, 24"x6"x4", three heats 1,400 to	1,800	"
Sweating blankets, 60"x18", with controller	800	"
Toaster stoves domestic, portable type, single heat 400 to	600	"
Toaster stoves, restaurant type, single heat 1,500 to	3,000	"
Towel dryers, three heats	600	"
Waffle irons, each section, single heat	385	"

Welding machines, smallest sizes ... ... 1,000 "
Welding machines, largest sizes ... ... 150,000 "

"VICTORIA" OFFICE OF THE BELL TELEPHONE COMPANY

—Electrical Equipment of new Montreal exchange—

On July 19th the Bell Telephone Company of Canada opened its seventh branch office in Montreal, the "Victoria," this being the first of the two proposed new offices for the Montreal Exchange in 1913, the other, "Rockland," (to serve the Outremont Exchange) being expected to be completed by the end of the year.

The "Victoria" office is situated in that portion of the "Main" district that is south of the Lachine Canal, including Verdun, and relieves the main office of approximately 1,500 subscribers lines. The building and equipment of the "Victoria" office corresponds very closely to that supplied for the "Gerrard" office recently opened in Toronto, and described in the convention number of the "Electrical News."

The building is 113 feet long by 40 feet wide, two storeys and with a high basement, designed to carry another storey in the future. The construction throughout is of the best fire-resisting type. Special attention has been paid to fire protection, stand pipes with the standard two and one-half inch hose being placed at different points in the building. Sprinklers are placed on the outside of the building over all windows on the upper storey. The front of the building is finished with hard burnt Laprairie plastic brick, No. 1 quality, and red sandstone trimmings. The design is of a simple, dignified character with a large window area, giving the building a maximum of light and air.

The main entrance is on the front, facing Chateauguay Street, the vestibule of which leads into a commodious entrance hall, from which the operators' quarters are entered, occupying the west half of the ground floor fronting on Charlevoix Street. The operators' quarters contain a large locker room (in which are placed the operators' clothes lockers and drying closet), lunch room, kitchen, rest and retiring rooms, and sick room. In the basement beneath the locker room, reached by a private staircase, are the operators' toilet and bath rooms.

The east half of the ground floor is entirely devoted to the housing of the power and terminal apparatus associated with common battery switchboards of the type being installed.

The entire top floor is used as an operating room and contains the subscribers' and incoming trunk switchboards. It is particularly well lighted and well ventilated.

The whole of the central portion of the floor of the operating room, that is between the switchboards, is raised 13½ inches higher than that portion of the floor on which the switchboards stand. This construction permits of the operators sitting on chairs of normal height, and, at the same time, more readily permits of their making any connection to the most distant parts of the switchboard which they are obliged to reach. At the same time access to all parts of the back of the switchboard is exactly the same as in buildings of earlier construction where the entire floor of the operating room is on one level.

A particularly good fire escape is provided outside the building, reached by doors swinging outward from the operating room and from the operators quarters to the ground.

In the basement are situated furnace and coal rooms, men's lavatories, battery room and cable terminal entrance.

The switchboard equipment is of the latest standard common battery relay type, and was supplied by the Northern Electric and Manufacturing Company, Montreal. The lines enter the building underground in lead-covered, paper insulated cables, and are connected to the main frame by silk and cotton-covered insulated cables. The main, intermediate and relay frames, the coil racks for the lines and in-trunk switchboards with their fuse panels, the power plant and two-position inspectors' desk are located in the terminal room at the east end of the ground floor.

The power plant consists of the main battery of 11-G chloride cells and a smaller set of 11-E-11 cells, the latter battery being used to reinforce the main battery for long distance work. Two Western Electric Company's motor generator sets are provided for charging the larger battery, one being held in reserve in case of a breakdown. Each consists of a generator of 18,000 watts capacity at 30 volts, directly connected to a 30 h.p. 550 volt, 3-phase, 25-cycle motor. The generators are of a standard telephone design specially built for charging telephone batteries, having a large number of segments in their commutators and with specially shaped pole pieces, the idea being to eliminate noise from the associated telephone service when the battery is being charged. The smaller battery is charged by a smaller generator which has an output of 600 watts.

Two machines are provided for furnishing alternating current for ringing subscribers' bells and with special interrupters arranged to give automatic intermittent ringing of subscribers' bells on calls originating from the other offices. These interrupters give an interrupted direct current to work the many signalling circuits required for an equipment of this type. The necessary switches, circuit breakers, measuring instruments, etc., are mounted on a black slate switchboard.

From this terminal room the lines are run to the switchboards on the floor above in switchboard cables supported on structural steel runways.

Two separate switchboards are provided, one to care for the subscribers' lines directly connected to this office and the other one, the in-trunk switchboard, to complete connections that originate from the other offices. Both switchboards have a capacity of 10,400 lines and are equipped for 4,000 lines. They are equipped with the latest types of circuits, those of the in-trunk switchboard include the keyless incoming trunk circuits.

All the structural steel telephone apparatus in the terminal room is painted with aluminium paint (not the usual grey iron filler paint) and gives the room a bright and cheerful appearance.

A special feature in connection with the cutover of the switchboards was the manner in which the actual transfer was made. The method used was a new one, and used for the first time by the company. Of late years and up to the present time, the method of opening the subscribers' line relays, in order to keep the signal lamp from burning in the new office, was by inserting a wooden toothpick between the cut-off relay coil and its armature. This was done some twenty-four hours before the cut-over, and necessitated leaving off the covers of the relays, which allowed an accumulation of dust to get into the contacts, beside the troubles that were caused by the armatures being stuck in such a manner as to prevent some lines from calling central. The new method was an arrangement that put the cut-off relay coils under practically the same condition as when being operated in service. After all the preliminary tests were completed, a four-volt battery lead was brought to the end of the subscribers' switchboard in No. 0000 cable. This lead was taken off the two cells at the grounded end of the twenty-four volt battery. At the switchboard, the lead, after going through a 300 amp. switch was attached to a number of fuse strips from which the current was distributed by smaller leads of No. 22 silk and cotton-covered copper wire to the multiple jacks on the board. The fuses on the strips were of five amperes capacity and each protected a lead of 20 lines. The No. 22 wire leads were connected to the multiple jacks by being wrapped around the heads of small metal service plugs which were inserted in the jacks. When all the preparations were made, the current was thrown on by means of the main switch being closed and the relays were operated and kept in that condition until the

word was given to make the transfer.

The charging machine circuit wiring was arranged so as to keep the two cells of battery floating, the machine carrying the load on the board.

At the hour set for the transfer, five o'clock in the afternoon, the temporary wiring connecting the lines being transferred to the old office was cut, the main switch opened, and the service plugs pulled out, the whole operation taking a very small amount of time.

COMPLETE CHAIN OF MARCONI STATIONS

—Government Extending its Wireless System—

By the end of the year the Marconi Wireless Telegraph Company of Canada, Limited, will have completed the chain of stations on the Great Lakes. Last year three stations were constructed at Sault Ste. Marie, Midland, and Tobermory, each group comprising two dwelling houses and one operating house. These are known as standard 5½ kw. stations, and each has a range of 350 geographical miles over open water and 260 miles over flat land. The masts are composed of 3 pieces of wood, and are 185 feet high. The operating houses are equipped with Canadian Fairbanks-Morse engines, all the apparatus being designed and manufactured in Canada. At each station the transmitting set is duplicated, so that in case of a breakdown of any part of the machinery, another set can be immediately brought into use—this being important in connection with shipping.

The Port Arthur station, built in 1910, is being remodelled, in order to bring it up to standard requirements. At Sarnia, a station has also been brought into operation, while at Port Burwell, Toronto and Kingston stations will be finished this year. When a suitable site has been obtained, a station will be erected in Montreal, thus completing the chain from Port Arthur, at the head of the lakes, to Quebec, down the St. Lawrence to Newfoundland as far as Cape Race in the south and Belle Isle in the north, covering in all a coast line of over 15,000 miles. With the stations on the Labrador, Nova Scotia and Newfoundland coasts, owned by the the company and the Dominion and Newfoundland Governments, there is a total of 40 stations, all intercommunicating and forming the greatest chain of wireless telegraph stations in the world.

Two large stations are now being erected at Le Pas, Man., and Port Nelson, on Hudson Bay. The Government are constructing a port at Nelson, and a wireless station will be among the first buildings erected. As in the other Marconi stations, the transmission plant at Port Nelson will be duplicated. The stations will be equipped with Canadian Fairbanks-Morse engines and 10 kw. wireless apparatus. This will give a range of 515 miles over water and 450 miles over land, day and night. Both stations will have two masts of tubular steel sections, totalling 250 feet, the masts being 650 feet apart. They weigh 20 tons each with the full equipment. The masts are of special design by the Marconi Company, and are specially suitable for wireless telegraph work in that they absorb much less energy from the transmitted electric waves than the lattice work steel towers used in the earlier days of wireless telegraphy. By means of two stations and the ordinary land wires, communication will be kept up with Port Nelson all the year round, and the building of the port greatly facilitated, as supplies can be ordered as needed. These stations will for the first time break into the absolute isolation that has existed at Hudson Bay settlement in previous winters; in the past the only communications that have reached Port Nelson during the seven months' winter have been those conveyed by dog teams, the drivers of which frequently underwent severe hardship. Thus another of nature's fastnesses is to be conquered by the advance of civilisation, first with its wireless telegraphy, then to be followed quickly by the steel road.

It is stated that the Yukon district may soon have its telegraph service improved, Marconi stations being substituted for the land lines and cables, which have been found very subject to breakdown in that wild and mountainous country.

Personals

Mr. Arthur J. Cantin, formerly sales engineer with the Gorman, Clancey and Grindley Company of Edmonton, Alta., has been appointed superintendent of the electric light and power department of the town of Melville, Sask.

Mr. H. C. Foss, who has been general superintendent of the Savannah (Ga.) Electric Company, has been appointed acting manager of the company. Mr. Foss was formerly superintendent of the Cape Breton Electric Company.

Mr. T. F. Swayze, superintendent of the Niagara Falls, Welland and Lake Erie Railway, Welland, Ont., has resigned to accept a position with the Niagara, St. Catharines & Toronto Railway Company at St. Catharines, Ont.



Mr. A. E. Grant

Mr. A. E. Grant has succeeded his brother, Mr. Lawford Grant, as managing director of the Canadian British Insulated Company, Ltd., Power Building, Montreal. Mr. A. E. Grant has had a wide experience as a marine, mechanical and electrical engineer, and has supervised some extensive contracts. His first position as an electrical engineer was with the Notting Hill (London, Eng.) Electric Light Company, for whom he erected some three-phase machinery, the second of its kind used in the British Isles. Subsequently he joined the engineering staff of the British Insulated and Helsby Cables, Limited, England, which has a large interest in the Canadian British Insulated Company. During his 14 years' connection with the British Company, Mr. A. E. Grant had charge of some important work, including the complete equipment of the Chesterfield tramways, and also the laying of extra high tension mains of the Metropolitan tramways. In 1906 he was appointed manager and chief engineer of the Cardiff office, which takes care of the company's business in South Wales and the south-west district of England. He comes direct from Cardiff to Montreal, and has now taken over the duties of Mr. Lawford Grant, who resigned to accept an important position with the Eugene F. Phillips Electrical Works, Limited, Montreal.

High-Efficiency Tungsten Lamp

As the result of investigations made in the research laboratory of the General Electric Company at Schenectady, N.Y., there has been produced a metallic-filament lamp which operates at the low specific consumption of 0.5 watt per candle—this efficiency being about twice that of the best incandescent lamps heretofore available. The new lamp has a specially shaped tungsten filament and is filled with an inert gas, such as nitrogen, at a pressure of about an atmosphere. The types which it is expected to develop first are adapted to the comparatively high current consumption of 6 amp. and over.

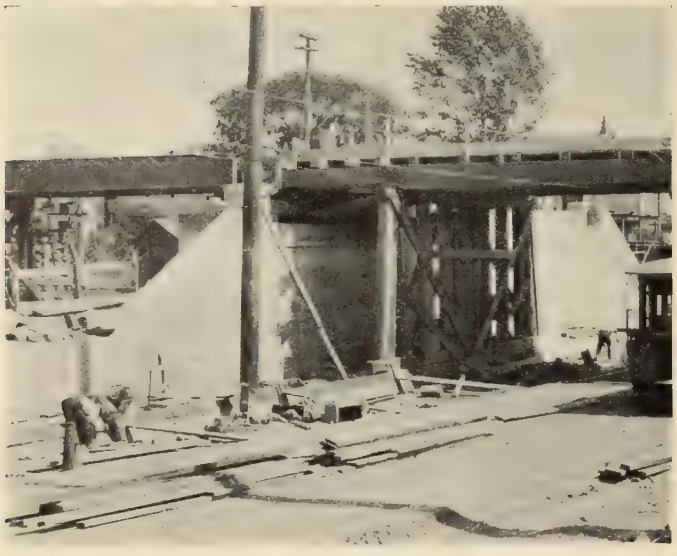
The instant that you make up your mind that everything is coming your way and that you need not hustle any longer, that minute things will stop coming your way.

Electric Railways

North Toronto Grade Separation

For a distance of some three miles across the north of the city of Toronto, the tracks of the Canadian Northern and the Canadian Pacific Railway Companies are being elevated to allow traffic to pass underneath along the roadways running north and south. On a number of these electric lines are operating, and at such points the tracks of the electric line will be depressed some 5 or 6 feet to allow the necessary headway. The reproduction shown represents an advanced stage in the construction work on Avenue Road. The electric tracks have again been laid down by the Toronto Railway Company and the cars are operating as usual. During construction work that part of the Avenue Road line lying north of this point was served by three cars to which it was necessary for passengers to transfer from the main Avenue Road line.

Subways similar to that shown will be constructed on Summerhill Ave., Yonge St., Avenue Road, Davenport Road, Spadina Road, Bathurst Street, Howland Ave., Christie St., Shaw Street, Ossington Avenue and Dovercourt Road, these highways all running practically north and south. The subways, with the exception of Yonge Street are of uniform construction and provide for a 66-foot roadway with 14-foot headway, which clearance will prove ample for all ordinary sorts of traffic. The subways are provided with stout side walls and approaches of concrete and a central dividing row of piers of concrete. The Yonge Street subway will be 86 feet in width and have an overhead clearance of 18 feet. This will be obtained by depressing the street level 9½ feet at this point. The picture shows a view taken from the north-west corner of the work with the eastern wing wall standing out prominently.



Construction work, Avenue Road

Montreal Tramways Mutual Benefit Association

The tenth annual report of the Montreal Tramways Mutual Benefit Association, composed of employees of the Montreal Tramways Company, has just been issued. It is for the year ended April 30, 1913, and gives a summary of the relief work done during the year as compared with the preceding year, as follows:

	1912-13	1911-12
Numbers of members disabled through sickness or injury	1,205	1,173
Number of visits made by physicians to disabled members	695	626
Number of consultations given by physicians to disabled members	7,690	7,587
Number of prescriptions issued	5,769	5,811
Amount paid for sickness and injury	$10,065	$10,274
Amount paid for medicine	$1,840	$1,725
Amount paid for pensions	$408	$354
Amount paid for withdrawals	$508	$296
Amount paid for death and burial insurance.	$7,083	$12,533

Mr. J. E. Hutcheson, general manager of the Montreal Tramways Company and president of the association, commented in his report as follows:

"It will be of interest to members to learn that since the organization of the association the following amounts have been paid out in benefits:

Death and burial claims	$67,643
Sickness and injury benefits	83,765
Medicine	14,648
Medical attendance	19,982
Pensions	1,755
Refunds	1,089
Total	$189,292

"Your committee of management gratefully acknowledges the special Christmas donation of $4,000 received from the Montreal Tramways Company. This makes the total contributions received from the company $18,318, and this amount added to the fees and dues received from the members, viz., $16,651, and the proceeds of the picnic, and the interest on investments, and bank deposits amounting to $15,506, make a total revenue for the year of $50,476. As the expenses were $28,795, the surplus is $21,680."

Two-Car Trains Operating in Hull

The Hull Electric Company are operating with success two-car trains as shown herewith to handle their traffic during the rush hours. The train is here shown passing around a curve of 40 ft. radius. The trailer has a combined entrance and exit at the front of the car and there are no steps at all provided at the rear. Both cars are operated p.a.y.e. with a conductor at the rear of the motor car and a conductor in charge of the trailer. The cars are fitted with Westinghouse S. M. E. air brakes and automatic car and air couplings. In handling the traffic during race week, between Ot-



Two car train rounding a 40-ft. curve on the lines of the Hull Electric Ry. Co.

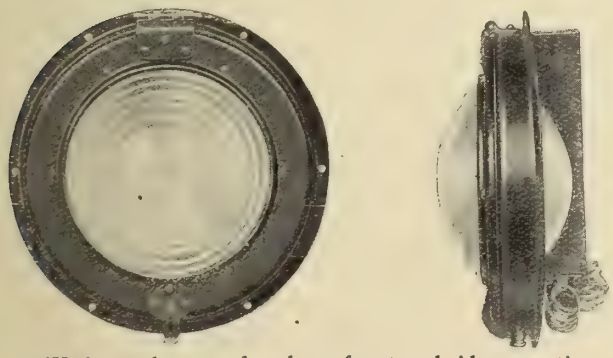
tawa and Connaught Park Jockey Club, this arrangement proved very efficient and economical.

A Pressed Steel Headlight

The Crouse-Hinds Company of Canada have just placed on the market a new headlight, known as type ZP, illustrated herewith. This headlight, which is arranged for flush mounting, is formed from No. 16 gauge sheet steel, and is very



Plain glass, flush mounting, front and side views



With regular semafore lens, front and side mounting

strong and of minimum weight. The housing and reflector are made in separate parts, permitting either to be replaced in case of damage so that it is not necessary to discard the entire headlight when only one part is injured. This arrangement also permits the removal of the reflector for repolishing.

Two styles of parabolic reflectors are made for this headlight, one formed from sheet steel with a smooth white porcelain enameled surface, the other formed of aluminium, highly polished.

The headlight is furnished either with plain glass, plate glass, or semaphore lens in the door, as specified. The door is regularly provided, at the bottom, with a spring catch, although, if specifically ordered, it will be furnished with a locking device that can be opened only with the aid of a socket wrench. This latter arrangement makes theft of lamps difficult. The headlight also is equipped with a porcelain socket, mounted on an adjustable bracket and located at top of headlight, which permits any standard incandescent lamp not exceeding 60 watts to be adjusted to focal point of reflector.

A suitable raceway for the wires is provided on the back of the headlight. A ½-inch conduit hub, with set screw, is located at the lower end of this raceway, making the headlight equally adapted to a conduit or exposed wire installation. The headlight is made with three different radii, namely: 7 ft., 5 ft., and 3 ft. 2½ in., for car dash with 6 ft. to 8 ft., 4 ft. 6 in. to 5 ft. 6 in. and 3 ft. to 3 ft. 6 in. radii, respectively. It will fit a 10¼ in. to a 12¼ in. hole in dash.

Montreal Tramways Good Year

For the year ended June 30th, 1913, the earnings of the Montreal Tramways Company totalled $6,754,227, the operating expenses being $4,032,664, leaving $2,731,562 as net earnings. Allowing for the city percentage, interest, etc., the net income was $638,331. Dividends absorbed $156,382, and after deducting $200,000 transferred to contingent account and $23,670 to capital reserve, and allowing $63,714 for discount on bonds sold, $194,564 is transferred to general surplus. The ratio of expenses to earnings was 59.71; car earnings per passenger 4.09c.; car earnings per passenger total carried 3.06c.; the total passengers carried was 159,892,021, and the transfers 53,505,304. Owing to the fact that the previous statement only covered nine months, no comparison can be made, but the directors state that the increase in gross earnings and the ratio of operating expenses to earnings are satisfactory. The following exclusive franchises have been granted to the company: parish of St. Laurent, 25 years; town of Mount Royal, 25 years; town of Pointe aux Trembles, 40 years; town of Montreal East, 40 years.

Escher Wyss & Company, Montreal, announce that they have severed their connection with Mr. C. J. Printz, who has been up to the present time their agent for the province of Ontario.

Illumination

Correct Illumination

(Specially contributed)

We are again approaching the season of the year when illumination plays one of the most important parts in both our commercial and home life. In the mind of the electrical man there is no other form of illuminant than electric lights, and this conviction is sufficiently backed by facts—cheapness, cleanliness, instant availability—to which must be added safety and artistic effect. These statements are not only not new, but have been repeated so often and are supposed to be so generally recognized that we perhaps forget that there are many people who may not yet have digested them. Proper illumination, with the emphasis on the "proper," is not merely an ideal of a Central Station manager but it reaches the very heart of our social and moral system; therefore it becomes the double duty of every one of us to bring before the notice of all light users the educative and refining value of "electric light" in correct proportions.

Perhaps, too, many of us have been in error in that we have been inclined to advocate "quantity" alone—which meant larger monthly accounts for the central station. This surely is the wrong course to pursue. There are undoubtedly some of our modern streets and especially many of our homes where there is too much glare—we will not say too much "light"—but if the light is not in excess its arrangement and control are so bad that it appears to be too intense. In homes especially, "quantity" ought not to be so much a prime consideration as "effectiveness."

With increasing knowledge of scientific illumination there is no doubt that more satisfactory results are being obtained—but the ideal is some distance ahead yet. The time is probably not far distant when cheapness of electric current will be considered as taking second place to efficiency; glare will give place to light and pleasing shadows, the white hard light to beautiful admixtures of colors.

The real stronghold of electric light, in the home at least, will be not so much in the candles per watt of energy consumed as in the manner in which it lends itself equally well to the combined requirements of illumination and decoration. The influence of a good light on the individual is now pretty generally appreciated but it is open to question if an artistic and beautifully lighted room does not exert a still greater control, and the uplifting value of the two combined with its ultimate influence on our race is a matter worthy of grave consideration by those in whose hands the supply of electric light rests.

The writer would not wish it to be understood that in advocating less glare and better control he is asking the central station to follow a policy which will reduce the revenue. On the contrary, it is evident that many homes, where there is now too much glare, are actually under-installed if a scientific plan of correct and decorative illumination were carried out.

The recent announcement of the invention of a tungsten lamp having an efficiency of one-half watt per candle will if it can be made applicable to the smaller units, effectively remove any competition by gas or other illuminant. This will hasten, in proportion, the day of scientifically correct illumination. The course of the illuminating engineers should therefore be perfectly clear—leading to lighting units in correct sizes and quantities, artistically designed and scientifically installed, that their influence may be stamped on the character of all and sundry who use them.

Electric Lighting of Laundries

By Mr. A.L. Powell, in "Lighting Journal"

One of the chief difficulties encountered in the laundry business is the retaining of experienced help, and the welfare of the employees is therefore an important consideration. The working conditions can be made much more agreeable by a little attention to the subject of good lighting, for it is a well known psychological fact that brightly lighted surroundings have a buoyant effect, and that a dim, dull room is highly depressing. Second, a plentiful supply of light promotes cleanliness; dust and dirt are not so likely to collect in corners and be missed by the sweeper or scrub woman.

Cleanliness is the keynote of the laundry business; and good lighting certainly promotes sanitation. Good lighting also prevents accidents to the employees operating the machines. As the result of experience and observation extending over a considerable period of time and in many laundries the conclusions as to good practice for general laundry work and in particular for the machines here illustrated may be stated as follows:

Lighting Systems

Localized general, or group lighting, means the use of medium size units hung moderately high, giving the maximum light at important points, as on the machines with a lower intensity at less important points as in the aisles. It is really general lighting, using common sense and judgment in the location of the lighting units. It is the method by which the majority of laundry processes can be most readily lighted. Analyzing the lighting requirements in a logical order can be more easily grasped by following through the various processes from the receiving to the final inspection and wrapping. In general all references to lamps are based on the dependable, highly efficient mazda incandescent electric lamps and the various reflectors specified should be of enamelled steel of some well known make.

Receiving, Packing, and Marking-in

This is usually done in a fairly large open space. The requirements for light can best be met by general illumination; that is, sufficient light must be provided in all parts of the room to run trucks back and forth with facility, open hampers, and read with ease the ofttimes rather partially obliterated, indistinct markings. For average ceiling heights, the flat dome type enameled steel reflector, hung about 9 ft. above the floor, is applicable on account of its high illuminating efficiency. About three-fourths of a watt per sq. ft.

of floor area is required. This would be given by 100 watt lamps spaced on outlet centers 11.5 ft. apart.

Washers

A localized general system of illumination is applicable here. The exact arrangement of the units will, of course, depend on the layout of the machines. The workman must be able to see the inside of the machine when loading or unloading. There must also be sufficient light to make the necessary gear adjustment, and to avoid accidents, either to the clothes or the workman from the gears and moving parts of the machine. With a single gear machine the light unit should be hung about 1 ft. in toward the center from the gear end, and in line with the front edge of the machine.

A 60-watt lamp with a flat dome reflector hung about 7 or 8 ft. from the floor, will meet the requirements set forth above, and there will also be sufficient general illumination for the soap tanks and aisles.

With the double gear washers, the units should be located above the center of the drum, and 8 to 9 ft. above the floor.

Stationary Tubs

Stationary tubs can be well lighted by a localized, general system of illumination, using efficient reflectors and allowing about half a watt per sq. ft. for the area under consideration.

Extractors

On account of the high speed of these machines and, hence, the greater possibility of accident, a relatively high intensity of illumination is required. The solid curb or under-driven extractors, if located in a row, can be lighted very well by one 60 watt lamp between each two machines. A bowl type reflector giving an intensive distribution of light is particularly suited to this requirement.

The overdriven extractor presents a slightly different problem on account of the liability of shadows from the mechanism. A 40 watt lamp with a 30 degree angle steel reflector, located in front of each machine, hung about 7 ft. high, will direct the light into the body, where required. Between each two machines in the rear a 40 watt lamp with dome reflector should be provided to furnish general illumination for repair work. The latter, of course, need only be used occasionally when this work has to be done.

Tumbler

The lighting requirements are the same as for the washers which have already been described.

Flat Work Ironers

These are made in so many sizes that it is hard to state definitely any one layout. The highest intensity of light is naturally required at the feeding and at the receiving ends. With the single-roll flat work ironer satisfactory light can be secured by locating 1-60 watt lamp with flat dome reflector over the center of the roll, about 8 ft. from the floor. With the multi-roll ironer, and the annihilator, particularly if the latter is equipped with a ventilating hood, at least two units are required; one over the center at each end. A 40 watt lamp with bowl type reflector, giving an extensive light distribution, is the proper unit, hung about 7 ft. from the floor.

Starchers

Collar and cuff, wrist-band and bosom. These are all relatively low machines with no overhanging parts; they are usually located in groups, and can be lighted by general illumination, simply taking care to locate the units so as to avoid heavy shadows on the work from the operators. With efficient flat dome reflectors, about half a watt per square foot is required.

Conveyor Dryers

The requirements here, a low illumination value, just to see to load, may be met with a 60 watt lamp, hung about 7 ft. from the floor, located in the middle of the rectangle formed by the racks and housing. This will light both the loading and unloading portion. A flat dome reflector should be used.

Dampeners

Collar, cuff and shirt—have approximately the same lighting requirements as the starchers—efficient flat dome reflectors with an allowance of half a watt per sq. ft.

Ironers

Collar and cuff, neck, wrist-band, sleeve, body and bosom. These machines are all relatively low, and hence can be lighted by general illumination, taking the precautions as stated above. A higher intensity of light is required than for the starchers and dampeners, for ironing is a final process; hence, more care must be taken. Allow from three-fourths to one watt per sq. ft.

Cuff, Yoke and Neck-Band Press, Seam Dampeners, Collar Shapers, Tab Tippers, Etc.

The above machines are relatively small and the processes are largely automatic on the part of the operators; hence general illumination will provide sufficient light for these operations.

Ironing Boards

Although general illumination will really suffice here, the work is usually fine and frequently the operator may stand in her own light, if a localized light is not provided. The best practice seems to indicate 1-25 watt lamp with bowl shaped steel reflector, hung near the left end of the board, and about 3 ft. above it. As ironing is done from right to left, with the lamp in this location, the iron will never cast a shadow on the goods about to be pressed.

Inspection and Wrapping

This is frequently done on benches with racks at the rear of the bench. Units of a relatively high intensity must be provided on these benches to enable employees to detect any blemish or speck in the finished product. Light must also be provided for the compartments of the racks. A double row of tables can well be lighted by a row of units in the aisle, say 60 watt lamps with bowl-shaped steel reflectors, giving an extensive distribution, spaced 8 ft. apart and hung about 8 ft. high. The single row can be lighted with 40 watt lamps equipped with bowl-type steel reflectors, intensive distribution, hung about 4 ft. above the bench, located in a row about 6 in. from the front of the bench, and spaced on about 8 ft. centers.

Rectifier-Tube Operating Records at Detroit

High average and individual life records in the operation of rectifier tubes have been attained by the public lighting plant at Detroit, Mich., where advantage is taken of the low-temperature cooling water flowing through the Detroit River from Lake Huron. One 4-amp. seventy-five-lamp tube has, for example, been in continuous service 11,629 hours. Another tube, started August 15, 1910, and ran until May 6, when it was removed after 10,562 hours use.

For the ninety-seven tubes now in use a total of 324,416 tube-hours has been recorded, an average of 3,344 hours per tube. Forty-five tubes now resting showed an average life of 2,692 hours, while 101 which have been discarded ran 2,696 hours each. These 243 tubes have altogether, therefore, run 712,831 hours, or an average of 2,933 hours per tube.

A mean operating temperature of 80 deg. Fahr. is maintained at the tubes, the cooling water taken from the Detroit River in front of the station ranging from 33 deg. in winter to 70 deg. in summer. Nearly 3,400 General Electric 4-amp. magnetite lamps are now in service for lighting Detroit's streets.—Elec. World.

The Dealer and Contractor

Electric Trucks in Contracting Work

Thousands of tons of coal and general building supplies have been delivered during the past three years in Detroit by three 5-ton electric trucks installed by the Electric Truck Company of Detroit and made by the General Vehicle Company, Inc. These three huge trucks, with traveling cranes, have attracted much attention on Detroit streets, where they have been seen daily and practically without interruption year after year, during warm and cold weather and on rainy days and on days when the snow was so deep that it prevented street cars from maintaining their schedule.

It is stated by the J. A. Mercier Company that these trucks have hauled on an average of slightly above 40 tons of coal and have traveled an average of 48 miles daily for years. It is the custom of the truck drivers to boost the batteries at noon. Under these conditions 48 miles are covered each day, but where the batteries are changed at noon the trucks will carry as high as 50 tons per day and will travel over 60 miles.

This is stated to be two and one-half times the amount of work that was accomplished by horses in the old days, and the Mercier company cannot see how it could have attended to the added work which has come to it within the last three years without the motor trucks. The work performed by these trucks during most of the day is the hauling of coal to the plants of the Central Heating Company, and a full 5-ton load is taken each time. The body is lifted clear of the truck with its load, dumped, and replaced, thus saving much time.

Another important installation is that of the A. A. Albrecht Company, whose offices in Detroit are in the Penobscot Building. This company employs constantly one truck of 2½ tons capacity and another of 3½ tons. The company has had the 2½-ton truck in use constantly for 3½ years, and the 3½-ton truck in use for one year. These trucks cover 35 to 40 miles a day, and are employed in carrying building material for use in the various business ventures of the company, which is one of the largest builders in Detroit.

Mr. Albrecht says "I cannot say too much for the work of my trucks. They are running all of the time. All we have to do is to keep them charged and they are constantly on the run. I have yet to see the time when there was an opportunity to 'knock' this installation, which has been a godsend to us. I presume that were we to install horse-drawn wagons for this labor our expense would be increased to at least three times what it is at present. When the motor truck came in, we recognized it as an improvement over all former methods of hauling, and we adopted it upon the same plan as we adopt any great improvement.

"The cost of taking care of our increased business during the past several years with horses would have been practically prohibitive, and would have cost us a fortune. The trucks entered our business when they were most needed, and horse-drawn wagons rapidly became obsolete with us. The total increased demand upon the delivery facilities in our business and its numerous branches was entirely taken care of by our power wagon equipment. The trucks have been in the repair shop but very little, and in fact I know of no serious complaint. We have often-times carried great over-loads without any trouble whatsoever. I believe that our general satisfaction has been due to the electric trucks, although I am informed to-day that since we secured these trucks, gasoline-driven vehicles have improved greatly. We use former teamsters, who have been educated in the operation of the trucks.

"Our men look very carefully after their trucks at all times and are very proud of their work. Upon returning from their day's work, the truck is placed in its regular location, the battery is taken away and charged, and the men arrive in the morning regularly in plenty of time to replace the batteries and to start their day's work. Each of the trucks receives a yearly overhauling."

In the yearly overhauling of the trucks, every part receives careful examination, and all parts needing renewal are replaced. It is noteworthy that there have been few replacements during the time the Albrecht company has owned these trucks.

As regards speed, with full loads of tile, lumber and cement, the trucks had at times covered easily six miles per hour. With five tons, the 3½-ton truck has covered six miles easily, although the regulation speed of the truck is but seven miles. The electric vehicle has proven a splendid puller.

Mr. Albrecht believes that the economy of the electric truck over the gasoline truck for short hauls is in the neighborhood of fifty per cent. at least, and in his enthusiasm he stated that the beauty of the trucks he had, laid in the ease of operation and in the fact that the trucks were working all of the time.

New Broadway Sign

The well-known Corticelli Kitten sign, formerly on the roof of the Albany Hotel, New York, has been removed from there and installed over the Heidelberg Building, on a much enlarged and more elaborate scale. The new display was installed by the A. and W. Electric Sign Company, of Cleveland, measures 100 feet long by 35 feet high, and uses 4,000 8-candle power mazda lamps.

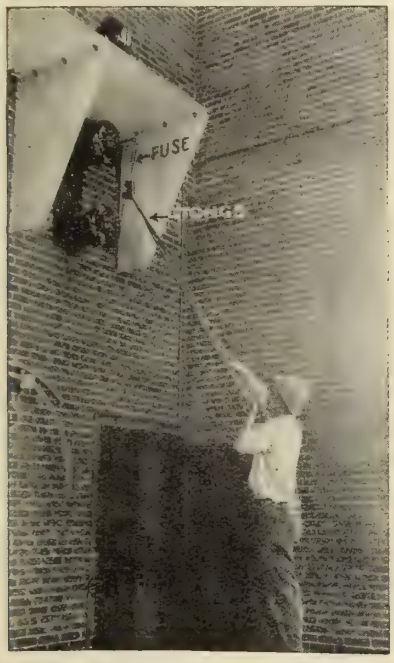
The display is installed in two sections—one occupying 52 feet on Broadway, and the other 48 feet on 42nd street, opposite the Times Building. A Reynolds flasher operates the sign on 42nd street, giving the kitten a very realistic moving effect, showing the spool of silk revolving as the kitten plays, the paws moving in quick action pulling the thread, which tangles around the paws and body of the kitten. A very life-like moving effect is given to the tail of the kitten as it plays with the thread. The wording, Corticelli Silk, Does Not Knot, flashes—each line separately.

The Broadway sign shows first the New Home Sewing Machine in outline, standing still. The machine begins to run rapidly showing the wheels revolving, the belt running with spool of silk on the machine revolving and feeding

rapidly to the moving needle bar; then the wording, Sew With Corticelli Silk, flashes on, followed immediately by the kitten at the left playing with the spool of silk. The kitten plays with the silk a few seconds, then raises to its haunches, and is attracted by the silk running through the needle of the moving sewing machine, the kitten drops down, and then leaps to the table of the machine and plays with the silk thread running down the needle bar and becomes entangled in it to such an extent that the machine stops, and then the entire display becomes dark.

66,000-Volt Sub-station Fuses

Among the recent developments in high tension circuit interrupting devices, the chemical fuse has taken high rank and its successful operation under severe short circuit conditions is rather remarkable. During the past three years, the lower voltage fuses have been extensively used and many tests have been conducted on all pressures up to 33,000 volts. A recent development for use on 66,000 volt systems is shown



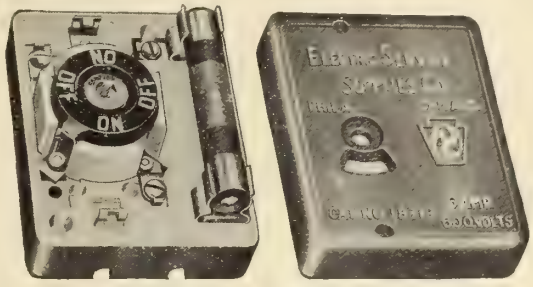
A new type fuse

in the accompanying illustration and the successful operation of this equipment is of interest to central station managers. This particular installation is used to protect a 3-phase sub-station taking current at 66,000 volts and transforming to lower commercial potentials. The illustration shows one phase of a three-phase service and also the method of handling the glass tube fuses by means of insulated tongs. Five ampere 66,000-volt fuses have been blown under heavy short circuit conditions on a feeder having behind it a generating capacity of 27,000 kv.a. The short circuit occurred close to the generators and the fuse successfully cleared the line in a fraction of a second. This new protective device is manufactured by the Delta-Star Electric Company, Chicago, who state that they are now conducting a series of investigations all on commercial potentials up to 110,000 volts. The cost of this circuit interrupting device is much less than that of oil circuit breakers or switches which is an important feature in selling current from high tension transmission lines.

The Rudel-Belnap Machinery Company, Express Building, Montreal, have recently been appointed representatives for the province of Quebec of the Packard Electric Company, Limited.

Improved Car Lighting Switch

A car lighting switch of improved design has been placed on the market by the Electric Service Supplies Company, to provide for the increased capacity required by modern car lighting installations. The adoption of a switch mechanism rated at 5 amperes gives them sufficient capacity to control several series of lamps. This mechanism is of the barrier type which will successfully handle 600 volts at considerably



Improved design car-lighting switch

above the rated ampere capacity. This is accomplished by operating the switch blades in a narrow slot between two porcelain barriers, allowing a very small air space which is virtually a vacuum, and which the arc cannot follow. Spring clips provide for a five ampere enclosed fume, which may be quickly replaced. These switches have bases 3⅛ x 4 inches, and are 1⅞-inch deep, with a cover in place, excluding the handles. The bases, cover and handles are made of chocolate-colored porcelain presenting an attractive appearance.

A New Porcelain Strain Insulator

A new porcelain strain insulator of remarkably high strength, both mechanically and electrically, has just been placed on the market by the Westinghouse Electric & Manufacturing Company, at East Pittsburg, Pa. The manufacturer recommends these insulators for use on 1500 volt direct cur-



Various sizes of new insulator

rent railway work and on 2200 volt transmission lines, a class of service for which porcelain insulators have been seldom used in the past. It is claimed that the insulators will stand more strain than any cable used in line construction that will pass through the hole. They are of the interlinking type which makes it impossible for cables to separate even if the insulator should become shattered. The glaze is of a dark brown color which does not attract the attention of those mischievously inclined. Sharp corners which would be apt to chip have been avoided and the shape of the grooves is such that the wires lie naturally in them. A large creepage distance is provided by the shape of the insulator which makes it suitable for high voltages. The smallest size of these insulators has a flashover voltage on rain test of over 13,000 volts, and the larger size, over 20,000 volts. The tensile strength of the larger size insulator is over 23,000 pounds, and its dimensions are only 5 x 4½ x 4½ inches.

The National Tube Company, Pittsburgh, Pa., announce that, commencing August 1, they are entering the electrical conduit field and have contracted with the National Metal Moulding Company and the Safety-Armorite Conduit Company, both of Pittsburgh, Pa., to manufacture and sell this product for them as their agents.

A New Single-Phase Motor

The Westinghouse Electric & Mfg. Company have placed on the market a new line of single-phase motors, made in capacities of 2 to 10 horse power and suitable for the majority of constant speed applications within their capacities. This motor is of the repulsion-starting type and when up to speed, runs as an induction motor. For most applications it can be connected directly to the line, but where very low starting current is desired, a starting rheostat can be used. The frame is so designed that it combines great strength and radiating capacity with minimum weight and over-all dimensions. The laminations are rivetted together under pressure and pressed steel end plates are rivetted to the unit thus formed. The foot, or base, is of pressed steel plate securely rivetted to the end plates; this use of pressed steel marks an important step forward in the design of large single-phase motors. The bearings are large and dust-proof. The rotor coils are form-wound and arranged to permit excellent ventilation. The commutator is of the radial type with undercut mica segments. The shaft can be pressed out of the rotor without disturbing the windings or the commutator. Each motor can be arranged for operation on either 110 or 220 volt circuits.

Electric Drills on Panama Canal

We illustrate herewith a typical scene of the construction work on the Panama Canal, showing 112 large size "Hard Service" electrically operated drills supplied by the Van Dorn Electric Tool Company. The advantages of electricity over compressed air for all similar types of work are now pretty well recognized. Efficiency of electric tools remains the same through their natural life which is not the case with pneumatic equipment, which tends to decrease with use. Also, as a general proposition, electric equipment will accomplish 50 per cent. more work and at one-third of the cost. Temperature effects are also inappreciable and electric tools are free from vibration, and easy to handle. There is also practically no limit to the distance electric tools can be taken from the source of power. Further, work can be continued, when necessary, after hours or at such time as the compressor would be shut down, as power can be taken from the lighting circuit.

Montreal Jovian Club

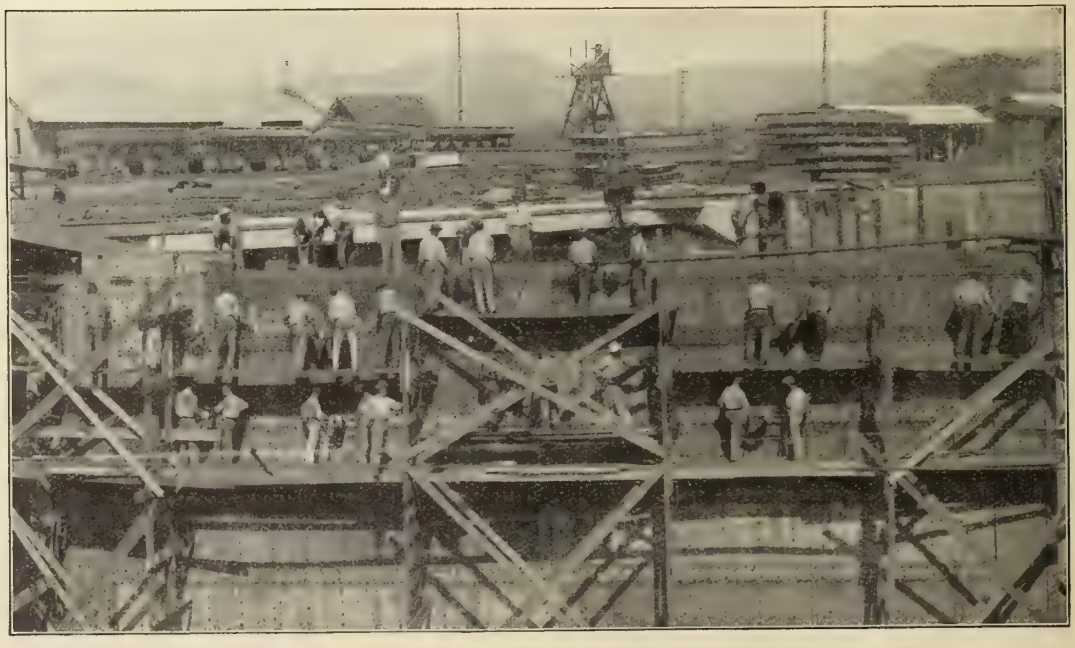
The Jovian Club has now been opened at Cooper's Restaurant, Montreal. The executive committee is composed as follows:—Messrs. W. B. Shaw, president of the Montreal Electric Company, representing the contractors; W. J. Doherty, sales manager Northern Electric and Manufacturing Company, representing the supply houses; R. M. Hannaford, engineers' department Montreal Tramways Company, representing the traction interests; C. E. Duncan, representing the manufacturing interests; C. M. Tate, chief inspector electrical department Canadian Fire Underwriters' Association, representing the inspecting interests; W. H. Winter, plant superintendent, Bell Telephone Company, for the telephone interests; and P. T. Davies, Montreal Light, Heat & Power Company, representing the power interests. Mr. James Bennett, president, and Mr. D. H. Ross, vice-president of the club, are also on the committee.

Silent Waverley Electric Boxed for Shipment to Japan

Boxing a $3,500 automobile for shipment to a distant part of the world is an important piece of work, since electric automobiles are not primarily designed to be lifted by derrick and dropped roughly down the hatchway of an ocean going ship. Within a week, however, two such shipments have been made from the Waverley factory at Indianapolis, one going to Lima, Peru, via New York, S.S. Allianca to Colon, across the isthmus to Panama and then down the west coast of South America by steamer again to Callao. The second shipment was of a Model 98 Silent Waverley Limousine-Five shipped via Chicago and Seattle in care of the Japanese line at that port to Yokohama, Japan, for delivery to the purchaser at Tokio, Mr. Kuhara, President of the Kuhara Mining Company.

International Engineering Congress, 1915

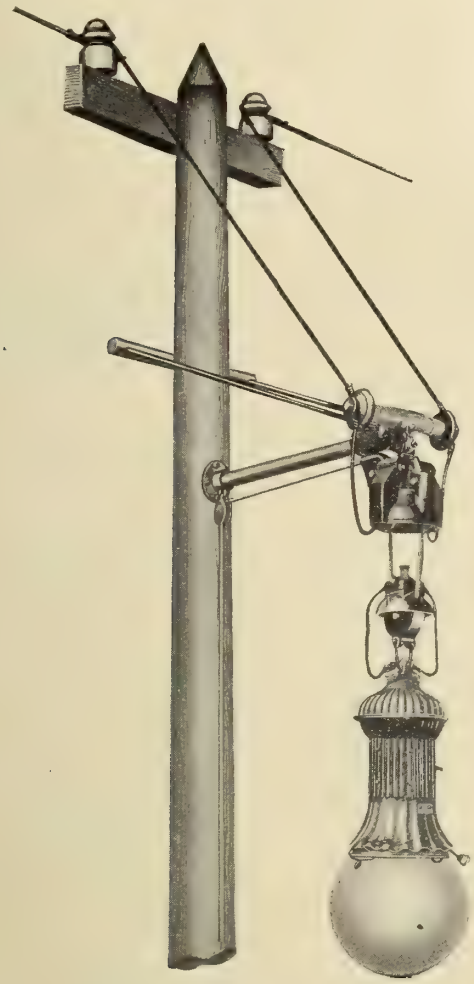
The Committee of Management of the International Engineering Congress, 1915, takes great pleasure in announcing that Col. Geo. W. Goethals, Chairman of the Isthmian Canal Commission and Chief Engineer of the Panama Canal, has consented to accept the Honorary Presidency of the Congress and will preside in person over the general sessions to be held in San Francisco September 20-25, 1915.



Van Dorn electric drills at work on the Panama Canal.

A High Voltage Cut-out Hanger

The Thompson Electric Company of Cleveland, have recently brought out a simple, compact hanger to take the place of the suspension equipment now used on series arc lamps. By its use the lighting of any lamp automatically cuts it out of the circuit without disturbing in any way other lamps in the same series. Two distinct advantages claimed in the use of this hanger are, that all wires are carried in straight lines from the pole to the hanger, and that the trimmer can perform his work with perfect safety because it is impossible for him to touch a lamp until it has been



High voltage cut-out hanger.

disconnected and lowered entirely away from the circuit. The figure shows the lamp just disconnected and ready for lowering to the ground. The latches and all current carrying parts are enclosed in heavy porcelains specially designed to afford good insulation and at the same time protection from the weather. It will be seen that the lamp is so supported that the trimmer is required to sustain only half its weight.

Contracts Let at Wasdell's Falls

In connection with the hydro-electric development which the Hydro-electric Power Commission of Ontario are undertaking at Wasdell's Falls on the Severn River and from which point they will supply power to the villages and towns in the neighborhood, the following contracts have been awarded:—dam and power house, Galbraith & Cate; turbines, Boving and Company of Canada; generators, Swedish General Electric Company; transformers and switching equipment, Canadian Westinghouse Company; stop-log winch and head-gate mechanism, Wm. Kennedy & Sons.

Trade Publications

Couplings and Pulleys—Bulletin 4320, issued by the Canadian Allis-Chalmers Limited, Toronto, descriptive of friction clutches, couplings and pulleys.

Fire Prevention—The Fire Prevention Company of Canada, Limited, Board of Trade, Montreal, have issued an illustrated pamphlet descriptive of the Reichel Automatic Fire Alarm signal system.

Correct Illumination—A leaflet issued by the H. W. Johns-Manville Company, describing Frink and J-M Linolite systems of illumination, with illustrations. The lighting of switchboards in central stations and telephone work is feature.

Small Motors—Monthly Publication No. 16, issued by the Industrial & Power Department of the Westinghouse Electric & Manufacturing Company. This number is devoted exclusively to the application of small motors to washing machines.

Line Material—The Line Material Company, South Milwaukee, Wis., is sending out a series of four folders, calling attention to the merits of "The Kyle Line" malleable iron bracket, pole line hardware and construction material, arc lamp insulators and hangers, and the "Hendee" flexible insulator bracket.

Motor Converters—Pamphlet No. 20-C, being distributed by the Bruce Peebles & Company, Limited, descriptive of Peebles motor converters. The principle of the motor converter is fully dealt with and under the heading "Uses of Motor Converters" it is shown that they are equally suittable for traction, lighting, traction and lighting combined, and for three-wire balancing.

Westinghouse—Folder 4223 describing Westinghouse electrical equipment for automobiles and garages, including a 6 volt, single-wire, starting, lighting and ignition system developed by that company. Pamphlet 4254, descriptive of Westinghouse 3-inch meters; these are adapted for automobile battery equipment. A descriptive leaflet 2321 covering type C S squirrel cage induction motors for constant speed service.

Illustrated Review—A record of industrial and other developments in the twin cities of Port Arthur and Fort William, published by the local branch of the Switchmen's Union of North America. The review is very complete, dealing fully, among many other things, with the electrical utilities in these two cities. It is splendidly printed and illustrated and is entirely a credit to the organization responsible for its production.

Calgary Facts.—The city of Calgary has issued a number of pamphlets dealing with the industrial and commercial phases of that district, and emphasizing the opportunities throughout the province of Alberta. Under the heading of "Cheap Power" it is pointed out that within a radius of a very few miles there is anthracite, bituminous and lignite coal which can be cheaply mined. The southern portion of Alberta is underlaid with gas wells with a larger daily producing capacity than any other locality in America, and the swift running mountain rivers passing through and adjacent to Calgary furnish hydro-electric power at lowest prices. Calgary is municipally owned, controlled and operated. All public utilities, such as street railway, electric light and power, waterworks and paving plants are operated on a satisfactory paying basis.

"Nulites" in Train Lighting

The Canadian Tungsten Lamp Company announce that they are now manufacturing 10 and 15 watt, 25 to 34 volt spherical train-lighting drawn wire tungsten lamps of the same high quality as the rest of their Nulite productions.

Current News and Notes

Aurora, Ont.

By a vote of 287 to 18 the property owners of the town of Aurora favored the expenditure of $16,000 for the necessary electrical equipment to distribute power recently contracted for with the Toronto and York Radial Railway Company. A second by-law authorizing the expenditure of $5,000 for the purchase of electric pumps was carried by the same majority. Work will be proceeded with at once. The number of street lighting units will be increased from the present 60 to about 300.

Brandon, Man.

Fire completely destroyed the local telephone office on July 24th. The loss is placed at $100,000.

Brantford, Ont.

The city of Brantford's claim against the street railway company for tax arrears now amounts to some $28,000. The feeling is in favor of the city taking over the system and operating it as a municipal enterprise.

Calgary, Alta.

Superintendent McCauley claims a record in the unloading, assembling and placing in operation, between 8 o'clock a.m. and 6 p.m. the same day, of two new cars recently received from the Ottawa Car Company. The latest arrivals bring the total of Calgary's rolling stock to 69, comprising 62 motor cars, 6 trailers, and 1 observation car.

The June net earnings of the Calgary street railway system were $12,136, as against $13,490 for the same period a year ago, though the gross was $65,967, as against $54,908 for June, 1912. This is an indication of the generally experienced rapidly increasing operating costs due in this case to a larger wage account added to increased power, interest and sinking fund charges.

Fort William, Ont.

The Board of Trade of the city of Fort William have requested their Utilities Commission to give a cheaper rate for current use for cooking purposes. In view of last year's considerable profit in this department it is suggested that the city could afford to offer a rate of 1½ c. per kw. h.

Tenders were called up to August 12, for extensions to the Fort William car barns.

Fort Frances

Plans submitted by the Ontario and Minnesota Power Company for the construction of a dyke along the Fort Frances river front and showing a railway along the top of the dyke, have been rejected by the town council.

Fergus, Ont.

The Hydro-electric Power Commission of Ontario has made an estimate on the supply of power to Fergus and Elora.

Georgetown, Ont.

The Hydro line from Guelph out to Rockwood and Georgetown has been completed and power was turned on in Georgetown during the first week in August.

Innisfail, Alta.

A by-law will be submitted on August 26 authorizing expenditure of $6,000 to complete the erection of the municipal electric light plant.

Kamloops, B.C.

The recommendations of the consulting engineers on the hydro-electric plant being installed for Kamloops, Messrs. DuCane, Dutcher & Company, recommend that the contract for the forty-three miles of aluminium transmission line and equipment be let to Messrs. Pierson, Rouding & Company. Other recommendations are as follows: telephone equipment, Northern Electric Company; turbines, Platt Iron Works; generators, Canadian Westinghouse; switchboard, transformers, and hardware for the transmission line, Canadian General Electric Company. The total cost is calculated in the neighborhood of $245,000. Mr. C. L. Wain is power-house superintendent.

Le Pas, Man.

Tenders are called up to August 20 for the construction of the power house to accommodate the new generating plant.

London, Ont.

The population census is at present being taken and it is anticipated that the London Street Railway Company may be required to extend their system another couple of miles as their agreement calls for extensions on a population basis.

Montreal, Que.

Tenders have been asked for the construction of the second portion of Montreal's underground conduits—from Craig Street to Pine Avenue, and between Atwater Avenue and Guy Street, on St. Catherine Street.

Owing to a small fire behind one of the switchboards at the Montreal central office of the Bell Telephone, the service in the main district was interrupted for three or four days. For a short time thousands of phones were put out of commission, but the company rushed men in from many points, and work was carried on day and night until the service was re-established. The fire was easily put out, but not before it had rendered useless a mass of wires.

It was stated at the annual meeting of the Canadian Light & Power Company, held in Montreal, that the connected load on the company's system amounts to 26,538 horse-power, while the number of light customers total 5,144 and power customers 581.

Following the passage of a recent by-law a license fee at the rate of 10 cents per square foot on all electric signs will be collected annually in the future in Montreal.

The North River Power Company are supplying current for lighting Rigaud, Point Fortune and St. Eugene, P.Q., the power being supplied by the National Hydro-electric Company from their power house at Carillon Falls. Another company is being formed to supply light to Vaudreuil, Como, Hudson Heights, Dorion and Ile Cadieux.

The board of directors of the Montreal Tramways Company has been increased from seven to nine, by the addition of Mr. P. J. McIntosh and Mr. W. G. Ross. The former gentleman is confidential assistant to Mr. W. Rockefeller, and is associated with a group of New York financial institutions; while Mr. Ross was at one time managing director of the tramways company. The board is now composed as follows: E. A. Robert, president; J. W. McConnell, vice-president; F. Howard Wilson, Geo. G. Foster, K.C.; W. C. Finley, Hon. J. M. Wilson, J. M. McIntyre, G. W. Ross, and P. J. McIntosh.

Nelson, B.C.

A by-law was recently defeated in which the council asked authority to guarantee bonds of the street railway system to the extent of $40,000 for the purpose of taking care of the company's present indebtedness and providing for additional necessary extensions and rolling stock.

Ottawa, Ont.

It is stated that the report which the conservation commission has been preparing on the Long Sault power development proposition will be ready in a short time for submission to the government. It is to be expected that the report will be unfavorable to allowing any United States company to develop and export power from the Canadian side.

Orillia, Ont.

An agreement has been reached between the Water, Light & Power Commission of the town of Orillia and the Department of Railways and Canals, Ottawa, whereby the town's power plant which is now situated at Ragged Rapids on the Severn River will be removed from that locality to a point known as Swift Rapids, some 1½ miles further down stream. This change is made necessary on the part of the government to facilitate work on their Trent Valley Canal scheme. It is also agreeable to the town of Orillia in that they will be able to install equipment of more recent date than that at present operating at Ragged Rapids. It is understood that the government will bear the entire cost of the new power house and will contribute a further sum of $25,000 in cash amounting to a total of at least $110,000. The town will have to supply a quantity of new machinery, the capacity at the new site being rated at about 3,500 h.p. By the move in location the head will be increased from 34 to 47 feet.

Prescott, Ont.

The transformer station here is being constructed by H. G. Wynes. The Canadian General Electric Company are supplying the equipment.

Peterboro, Ont.

The present feeling of the power committee of the Peterboro city council is that the property of the Peterboro Light & Power Company be expropriated and the price arranged later by arbitration.

Rockwood, Ont.

During the first week in August electric light supplied from Niagara by the Hydro-electric Power Commission of Ontario was turned on here for the first time.

Regina, Sask.

The operation returns for the municipal street railway system for the city of Regina for the week ending July 19 showed a total revenue of $3,683.10. The number of passengers carried, exclusive of transfers, was 93,196. For the week ending July 26 the corresponding figures were $4,011.50 and 94,970.

In connection with the Regina Street Railway System, the City Commissioners have given an order to Bruce, Peebles & Company, Limited., Edinburgh, for a motor converter set. The contract was placed through Roper, Clarke & Company, Montreal. The converter is 1,200 kw. at 550-600 volt d.c., taking current at the a.c. end at 2,200 volt, 60-cycle, 3-phase. It will run at 450 r.p.m., and is a 3 bearing machine, complete with switchboards.

St. John, N.B.

Mr. W. H. Balcke of the Stone & Webster Engineering Corporation is reported to have been looking over the situation at Meductic Falls preparatory to the commencement of development operations this fall.

St. Catharines, Ont.

On August 1st the rate payers voted favorably on the enabling by-law as a result of which an estimate will be prepared by the Hydro-electric Power Commission at the cost per h.p. of supply at this point.

Tillsonburg, Ont.

The Tillsonburg Electric Car Company has been finally organized with the following officers: C. G. Davis, president; V. A. Sinclair, vice-president; J. T. Bailie, manager; Jas. Chandler, superintendent; Jno. McIntyre, L. Merrill, G. W. Tillson, H. Schafer and William Russ, secretary-treasurer. The building is reported to be nearly complete and that operations will be commenced in the near future. It is said that a considerable order has already been received.

Toronto, Ont.

The Canadian Moloney Electric Company have opened their Toronto office in the new C. P. R. Building.

By the end of the present year it is calculated that half the collegiate institutes and public schools will have been wired for the use of electric light and small quantities of power.

Gross earnings for the first seven months of the Gerrard street municipal electric railway line are in excess of the operating expenses by some $1,500. This however, does not make any allowance for depreciation or interest charges on the original investment which would be between $11,000 and $12,000 for the same period.

The council of the township of York have voted in favor of giving a 20-year franchise to the Forest Hill Electric Railway Company, but it is understood the matter has yet to be submitted to the township rate payers before the franchise can take legal effect.

Appeal against the decision of the High Court being made by the Toronto and York Radial Railway Company in the matter of the diversion of its tracks from Yonge Street at Farnham Avenue will come before the Privy Council in London during October next.

It is reported that the Hot Point Electric Heating Company, of California, will build a large branch manufacturing plant in Toronto.

The gross receipts of the Toronto Railway Company for the month of July were $500,021, of which the city's share is 20 per cent. or $100,004. It looks as if the city would receive approximately $1,000,000 in revenue from the company this year.

Two or three electric trucks will be required in the near future in the baggage transportation department of the Union Station. Mr. Ambrose is chief of this department.

Works Commissioner Harris has been asked to report on further extensions to the municipal street car system, including, Wychwood, Leaside, North Toronto and other outlying points.

Winthrop, Ont.

Plans have been drawn for an extension to the McKillop township telephone system to cost in the neighborhood of $2,400.

Watford, Ont.

The town council contemplate the installation of a lighting system. Power to be supplied by the Hydro-electric Power Commission of Ontario.

Weston, Ont.

Extensions to the distributing system throughout the township of Etobicoke are being planned by the Weston Water, Power and Light Commission.

Winnipeg, Man.

The contract has been awarded for 90 double arm and 40 single arm ornamental combination street lighting and railway standards. The poles will be supplied by Dawson & Company, who are agents for the Electric Railway Equipment Company.

The Commercial Power, Light and Coal Company, Limited, has been incorporated with a capital of $250,000, with head office at Winnipeg.

The Winnipeg Electric Railway Company are at present rushing construction work on the new line to Fort Garry. It is reported that the company have already over three miles of rails down and the trolley wire strung and that the grading work has been done on another three miles.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

Engine and Generator For Sale

Owing to the Town of Stayner having secured a supply of power from the Hydro-Electric Power Commission of Ontario-this equipment will not be needed after Sept. 1st. 1913.

1 100 H.P. 2 cylinder vertical Fairbanks-Morse Gas Engine, complete with oiling system, 5 years old.

1 Fairbanks-Morse Gas producer, complete for above.

1 30 K.W. 1,000 volt, 133 cycle single phase Royal Electric Generator, complete with exciter.

1 set of line shafting, complete with pulleys, clutches and belts.

1 marble panel switchboard with control equipment for generator and exciter.

1 Bulldozer Power Pump.

1 Duplex Plunger Pump.

1 Water Motor.

JOSEPH KNOX,
Stayner, Ontario.

Car Ventilating Systems

The Cooke System of Mechanical Car Ventilation. Specifications and estimates furnished. Manufactured in Canada under Canadian Patent 128070. Vacuum Car Ventilating Co., 561 W. Monroe Street, Chicago, Ill. 11 t.f.

For Sale

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1	540	Gen. Elec., 6-pole, form F, comp., 30 kw. direct-connected to 11 x 8 in. Gen. Elec. vertical marine type engine, 125 volt	305
1	1300	Northern, MP, 75 kw., comp., direct-connected to Racine vertical cross comp. engine, 125 volt	275
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CITY OF MONTREAL

Notice to Contractors

Contract No. 2

Tenders for the Construction of a System of Underground Conduits, Manholes, Transformer Chambers, etc.

Sealed tenders in an envelope provided for the purpose, and addressed to the undersigned secretary of the Board of City Commissioners, will be received at the offices of the said Commissioners, City Hall, Montreal, in the Province of Quebec, until twelve o'clock noon, on the 15th day of August, 1912, for the construction of a system of Underground Conduits, Main and Service Manholes, Transformer Chambers, etc., in, upon, and adjoining that portion of St. Catherine Street, between Atwater Ave. and Guy St., in the City of Montreal.

Tenders will be considered for the whole and not for a part only of the above mentioned works, and persons tendering are notified that tenders will not be considered unless made on the printed forms supplied by the Commissioners.

Plans, specifications and forms of tender may be obtained at the office of the Electrical Commission, 1009 New Birks Bldg, any day during office hours, upon payment of a deposit of One Hundred Dollars, which amount will be refunded after the receipt of a bona fide tender and the return of the said plans, specifications and other documents.

Each tender must be signed and sealed by all the parties to the tender, and duly witnessed, and be accompanied by an accepted cheque on a Chartered Bank of the Dominion of Canada, payable at Montreal to the City Treasurer, for a sum of Five Thousand Dollars ($5,000) to be increased (if required) before the contract is signed by the accepted tenderer to an amount equal to ten per cent. (10 p.c.) of the amount of his tender.

The person or firm whose tender is accepted shall, within ten days after the final acceptance thereof, sign the contract, specifications, and other documents required to be signed, and in case of the refusal or failure on the part of the person or firm whose tender is accepted, to complete and execute the contract with the City Commissioners, the said cheque shall be forfeited to the City Commissioners as liquidated damages for such refusal or failure, and all contract rights acquired by the acceptance of the tender shall be forfeited.

The cheque deposited by the person or firm whose tender is accepted will be deposited to the credit of the City of Montreal as security for the due and faithful performance of the contract according to its terms.

The cheque deposited by the person or firm whose tender is rejected will be returned within ten days after the signing of the contract.

The lowest or any tender will not necessarily be accepted.

By order,

L. A. HERDT, Chairman,
The Electrical Commission of the City of Montreal.

L. N. SENECAL, Secretary.
Board of City Commissioners.

Newspapers inserting this advertisement without authority will not be paid for it.

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Position Wanted—Engineer, electrical and mechanical, age 26, with extensive workshop experience and University training, desires suitable engagement; more particularly on the sales staff. References. Box 851, Electrical News, Toronto, Ont. 16-17

Moonlight Schedule for September 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
Sep. 1	7 00	Sep. 2	4 50	9 50
2	7 00	3	4 50	9 50
3	7 00	4	4 50	9 50
4	7 00	5	4 50	9 50
5	7 00	6	4 50	9 50
6	6 50	7	4 50	10 00
7	6 50	8	4 50	10 00
8	6 50	9	4 50	10 00
9	11 00	10	5 00	6 00
11	0 00	11	5 00	5 00
12	1 10	12	5 00	3 50
13	2 10	13	5 00	2 50
14	No Light	14	No Light	
15	No Light	15	No Light	
16	No Light	16	No Light	
17	No Light	17	No Light	
18	6 30	18	8 40	2 10
19	6 30	19	9 10	2 40
20	6 30	20	9 40	3 10
21	6 30	21	10 20	3 50
22	6 30	22	11 10	4 40
23	6 30	24	0 10	5 40
24	6 20	25	1 20	7 00
25	6 20	26	2 40	8 20
26	6 20	27	4 00	9 40
27	6 20	28	5 10	10 50
28	6 20	29	5 10	10 50
29	6 20	30	5 10	10 50
30	6 10	Oct. 1	5 10	11 00

Total Hours.....187 30





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Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 618 Union Trust Bldg.
Montreal, Winnipeg, Vancouver, Calgary } Northern Electric & Mfg. Co.
Toronto, 76 Bay Street.
London, Audrey House, Ely Place, Holborn.
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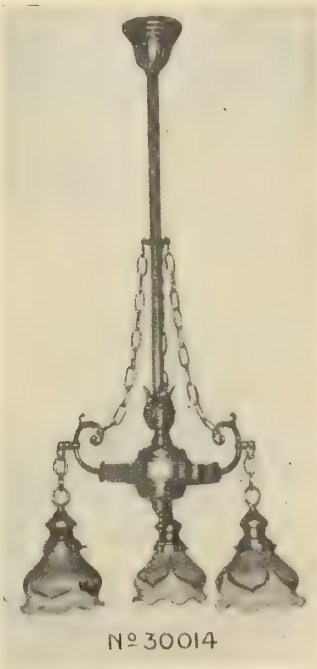
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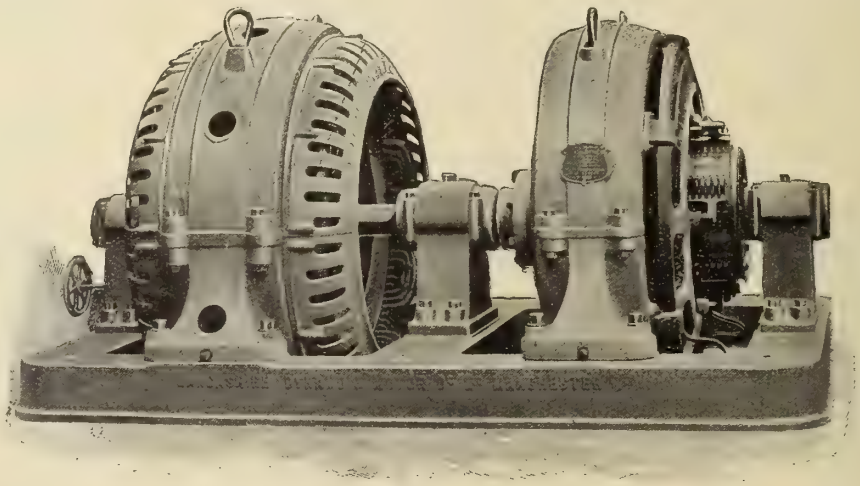
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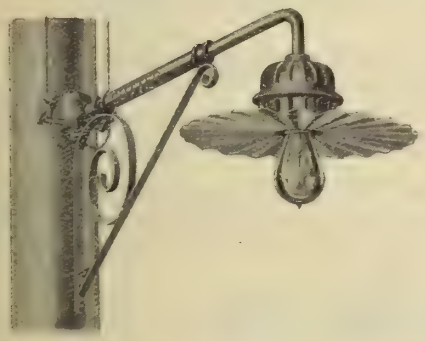
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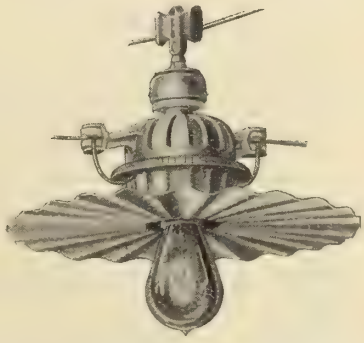
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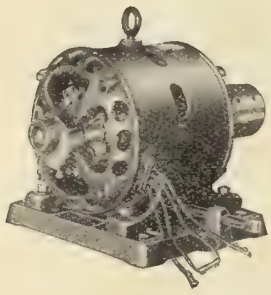
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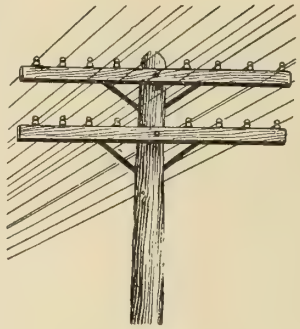
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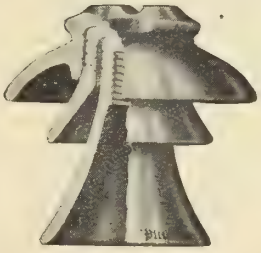
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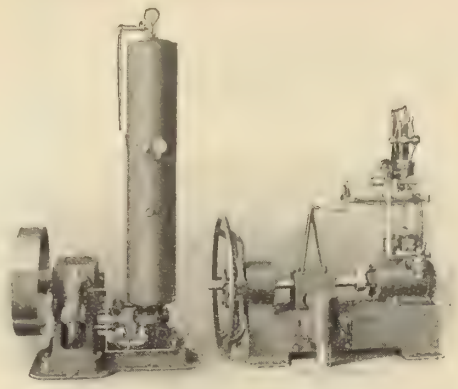


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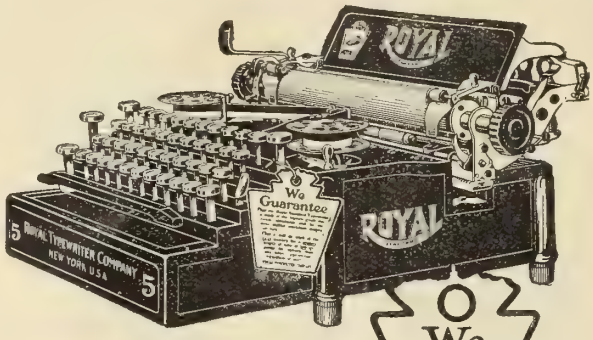
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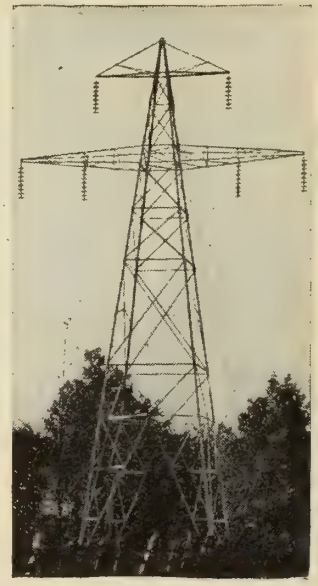
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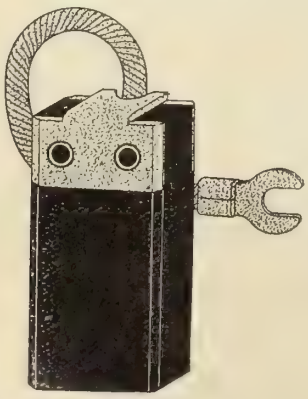
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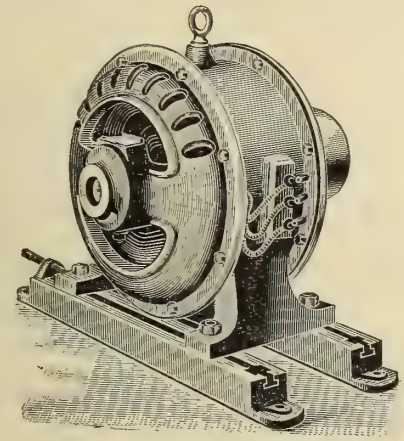
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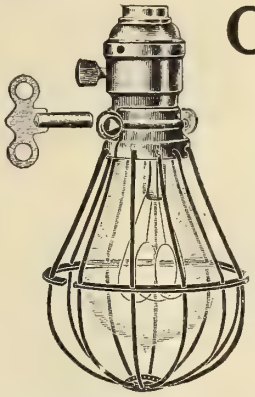
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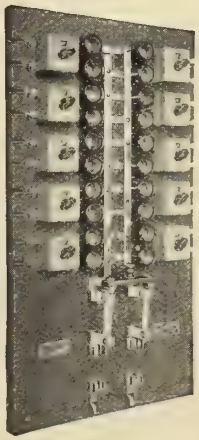
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Central Electric & School Supply Co., Limited

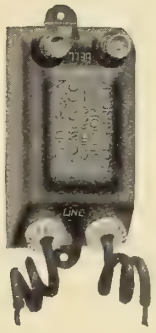
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Of Guaranteed Quality



Carefully designed and constructed by experts you can make no mistake in handling the

Thordarson Junior Bell Ringing Transformer



It is small, light and compact, consumes no current and is absolutely trouble proof. Thordarson Bell Ringers are made in 5 styles to meet all classes of signal work and are fully approved by the Board of Underwriters. Write to-day for prices and discounts.

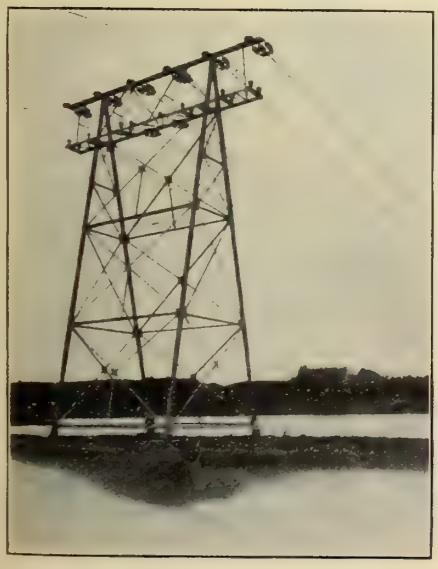
THORDARSON ELECTRIC MFG. CO.

503 South Jefferson St., Chicago

The Steel Company of Canada, Limited

Manufacturers of

COPPER WIRES AND CABLES



Consult us regarding—

Bare Copper Wire
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for

Electrical Construction Work, Transmission and Trolley Systems

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Constant Conductivity

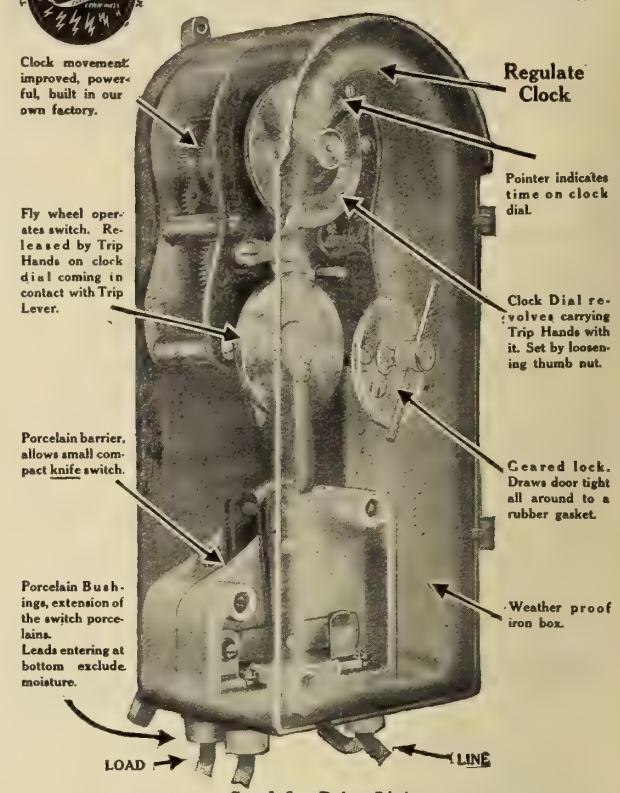
Constancy is a virtue in most things. When applied to conductivity of Rail Bonds it is a virtue of the first water.

Electric Weld Rail Bonds have a high conductivity that is constant.

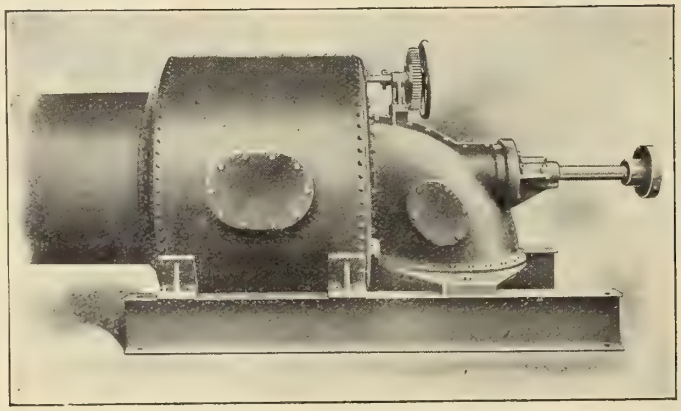
We solicit your inquiries

The
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CAMPBELL TIME SWITCH
THE BEST (PATENT)



Send for Price List
CAMPBELL ELECTRIC CO., LYNN, MASS.
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Samson Water Wheels

The Samson wheel shows its highest efficiency at the gateage most frequently used—from ¾ to ⅞ gate opening. At these stages, in **official** tests, it has shown efficiencies as high as 89.99%.

When driving electrical generators, water wheels are required to develop the normal power of the generator at about ¾ gate opening—therefore this wheel is specially suited for this work.

These results are also a real assurance to you that the Samson wheel will give the best possible results under **your** conditions.

The durability, strength, workmanship and performance of the Samson are all fully guaranteed and we take all risk.

Can we serve you in any way now?

William Hamilton Company, Ltd.
Peterborough, Ontario

Pressed Steel Dash Headlights

Practically only two parts —door and back reflector case; reflector and back case in one piece.

Reflector of white porcelain enamel.

Can furnish either semaphore or plain lens.



No. 14



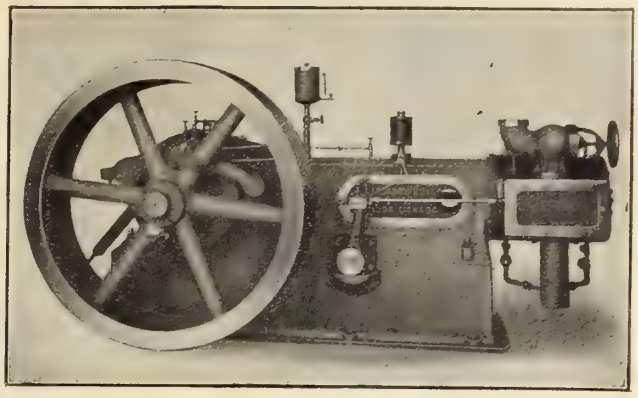
No. 15

Made in type to be set in dash, or to be screwed outside of dash.

Weight is but ten pounds, as compared with 25 of cast iron.

Can furnish ruby lens to be used as rear markers.

The Trolley Supply Company
Canton, Ohio, U. S. A.

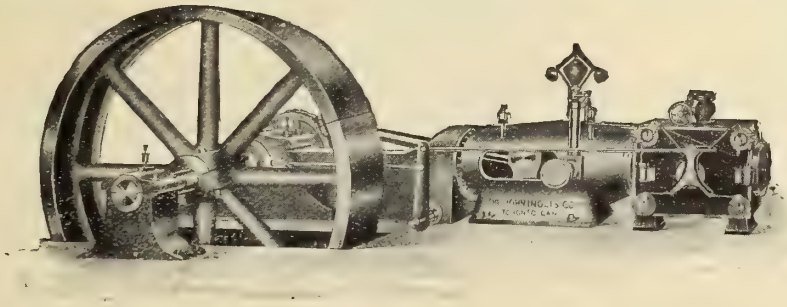


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BOILERS — HEATERS — PUMPS
TANKS AND STACKS

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AGENCIES: St. John, N.B. Montreal Toronto Winnipeg Calgary Vancouver

ENGINES



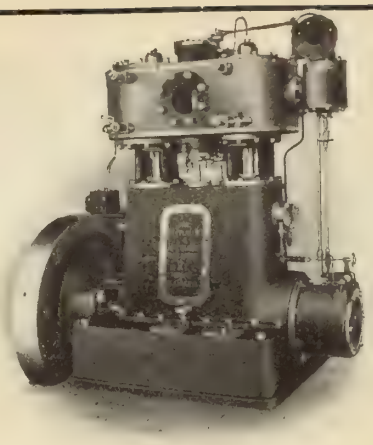
Are you interested in efficiency? When an order is placed with us for an "Inglis" Corliss Engine, it is handled step by step by experts in their different lines. Men who have proven themselves capable by long apprenticeship, take a personal pride in producing the "Inglis" Corliss Engine, a product without an equal—Write us.

The John Inglis Company, Limited

Engineers and Boilermakers

14 Strachan Avenue, TORONTO CANADA

A. Angstrom—Montreal Representative, Room 509 Canadian Express Building



Vertical, Forced Lubrication

Quick Revolution Engines

With Combined Throttle and Expansion Governor

These engines are giving excellent service wherever installed. They are built for service and are economical in consumption of steam and require little or no attention while running. The materials used are in accordance with British Admiralty Specifications. Ask for detailed information.

All Engines are Tested under Steam before leaving our works

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"The Recognized Authority on Wiring and Construction"

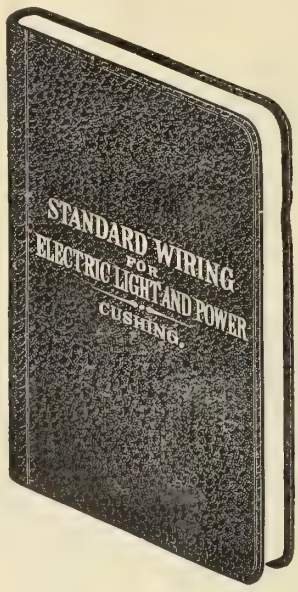
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Over 267,000 Sold

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Member American Institute of Electrical Engineers; formerly Electrical Inspector for Boston Board of Fire Underwriters and Underwriters' Tariff Association of New York.

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is the only book on Electric Light and Power Wiring and Construction endorsed and recommended by every Board of Fire Underwriters in the United States and Canada, because it is the only one kept strictly up-to-date and revised every year in accordance with every rule and requirement of the

National Electrical Code

which it contains, explained and illustrated. The 1912 Edition has been completely revised from the first to the last page, and contains new illustrations, tables and diagrams in accordance with the latest and best practice.

"It settles disputes and, if referred to before wiring, prevents disputes."

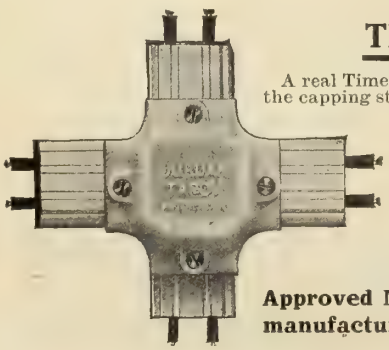
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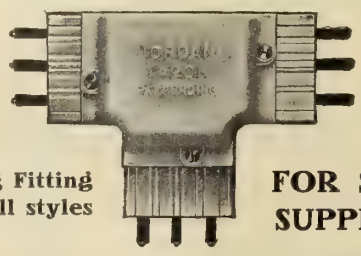
Electrical News, 220 King Street West, Toronto, Canada

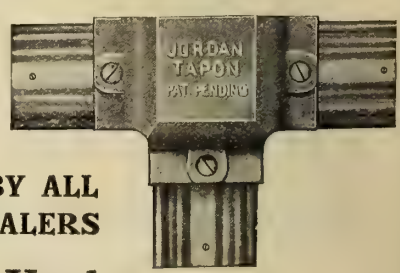
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Cut This Out Today ⟶ *—paste it in a convenient place—you may need it at a moment's notice.*

For All Kinds of Repair Work
The Electrical Maintenance & Repairs Co., Ltd.
162 Adelaide St. W. TORONTO
Local and Long Distance Phone } Adelaide 902-903
Nights, Sundays, Holidays } Geo. T. Dale, Mgr. Beach 1723; R. B. Bothwell, Supt., " 1930

DELAYS ARE COSTLY

Did you ever have any part of your Electrical Equipment suddenly go out of commission? You know what such an occurrence means—the demoralization of a part of your plant and in many cases a complete "Shut-down" to await repairs. In such instances you need

EXPERT REPAIRMEN AND QUICK SERVICE

We have ready at all times a staff of experts, available for all kinds of local and out-of-town repairing. A phone message to our office will be the means of getting one or more of these men to your plant in the shortest possible time.

A complete stock of supplies, switches, fuses, lamps, wire, etc., is at your service, also a number of rebuilt Direct and Alternating Current Motors and Dynamos and Electro Plating Dynamos.

GET OUR PRICES

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Long Distance Phones A-902-903 — 162 Adelaide St. West, TORONTO — Nights, Sundays and Holidays, Geo. T. Dale, Mgr. Beach 1723

EQUIPMENT SERVICE

The building of high-speed compound engines which run economically for years, and boilers which combine low cost steaming with the highest grade of workmanship known to the boiler-makers' art is but one function of our engineering organization.

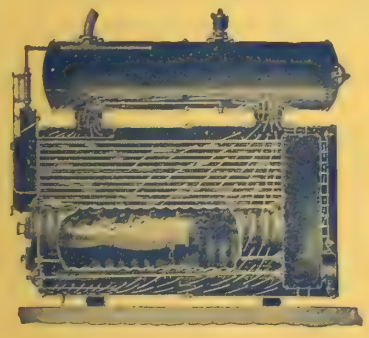


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The new two-million dollar Grand Trunck Pacific Hotel is an example of our achievements in power-plant equipment—steam, electrical, refrigerating, water-softening, etc.

In this hotel there are

THREE ROBB Scotch Boilers and THREE ROBB Vertical Compound Engines



Fully described in Bulletin No. 201.

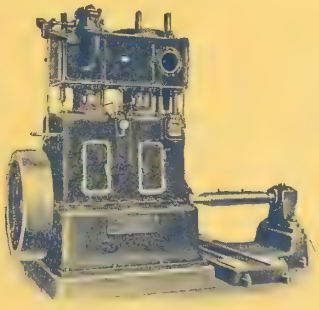
INTERNATIONAL ENGINEERING WORKS, LIMITED

MANUFACTURERS OF

ROBB ENGINES, BOILERS, ETC.

AMHERST, N.S., CAN. So. Framingham, Mass.

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Speaking of **CIRCUIT BREAKERS**

there is a new trick in our trade. Most engineers specify "I-T-E" when they want the best, a few "I-T-E or equal." This frequently results in a scrap. Everyone claims his to be "as good as I-T-E" tho' he knows better.

When we point to cross section, contact area, etc., our competitors are compelled to step up a size, or two sizes as the case may be in their endeavor to approach equality of carrying capacity.

They are obliged to put in a thousand ampere breaker and call it a six hundred. This gives copper but omits altogether the co-ordination of design with capacity.

"Father's pants will not fit Willie." Shortened at the legs, they don't come right at the middle.

Better say I-T-E and be right all over.

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I-T-E Electric Co., 72 Finsbury Pavement E.C., London, Eng.
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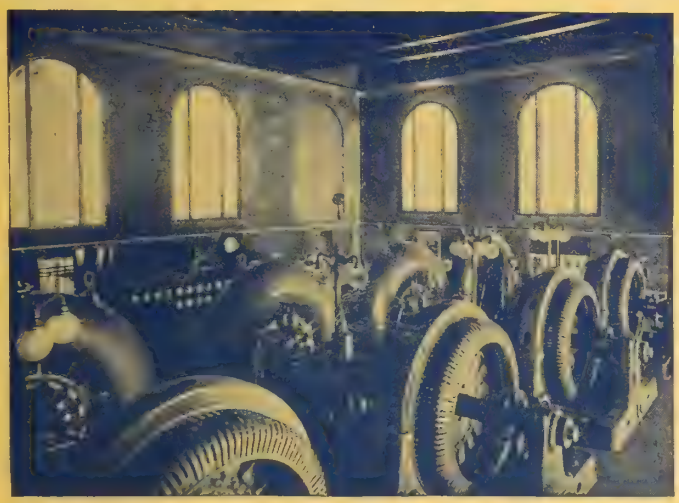




Vol. XXII—No. 17 Toronto, September 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



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Power house of the Metropolitan Water and Sewerage Board, Clinton, Mass. (now owned by State of Massachusetts), where we have four hydraulic turbine units, each of 1600 Horse Power, under 100 ft. head, in constant operation. Turbines designed for heads from 5 feet to 600 feet.

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The C. G. E. Drawn Shell Small Power Motors are unique in the simplicity and compactness of their design. Hundreds of them are in daily use giving perfect service under a wide variety of conditions.

CANADIAN GENERAL ELECTRIC CO.

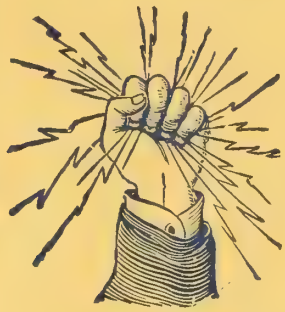
LIMITED

HEAD OFFICE - TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Fort William Winnipeg Regina
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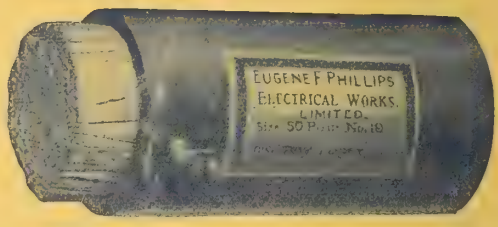
PHILLIPS



Bare and Insulated Copper

WIRES AND CABLES

For Telephone, Telegraph, Lighting, Power and Street Railway Equipment

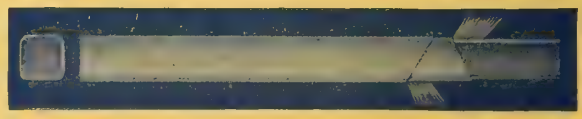


Bare and Insulated Electric Wire and Cables for Aerial and Underground use

Railway, Feeder and Trolley Wire



Weatherproof Magnet and Rubber Covered Wires and Cables

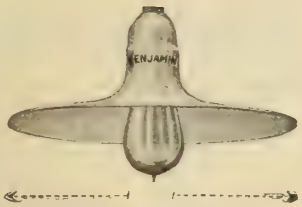


Incandescent and Flexible Cords

Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

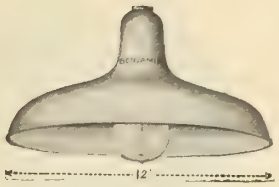
Branches: Halifax, Toronto, Winnipeg, Vancouver



Flat Reflector Socket
Cat. No. 5402



Outdoor Streetlite
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Bowl Reflector Socket
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Reflectors and Fixtures
for your
Fall Lighting Equipment

A Fixture or Reflector for Every Requirement

Benjamin Fixtures and Reflectors are carefully designed to give proper and maximum illumination.

Send us blue prints or sketch of your factory.

Let our engineering department offer its recommendations.

Catalog C-21 is full of various styles and types. Send for it today.

"BUY BENJAMIN"

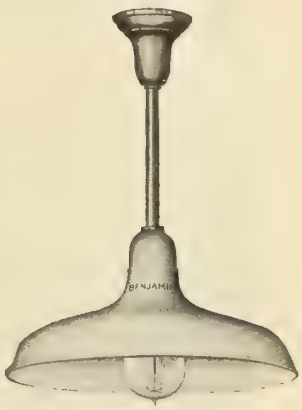
Made in Canada
FROM YOUR JOBBER

Benjamin Electric Mfg. Co.
of Canada, Limited

11-17 Charlotte St. Toronto



Office Fixture
Cat. No. 1004



Office Fixture
Cat. No. 6046



Adjustable Reflector
Cat. No. 6162



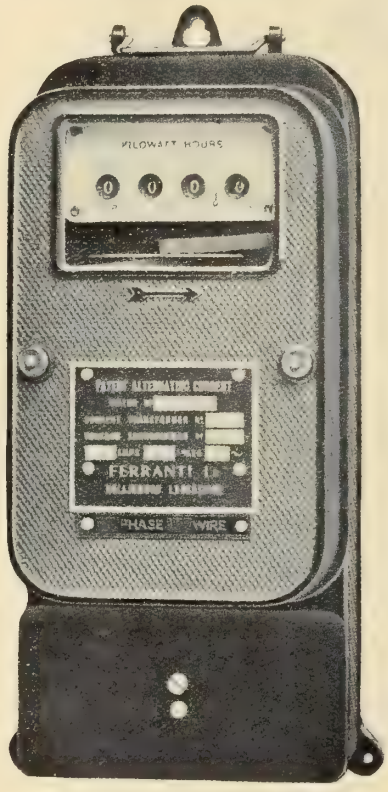
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Cat. No. 5412



Deep Bowl Reflector Socket
Cat. No. 6168



SINGLE PHASE METER.



POLYPHASE METER.

Ferranti Meters

Single Phase and Polyphase

Type "C"

Represent the *highest* grade of mechanical and electrical construction.

The electrical design is the result of years of research and wide experience, while the mechanical arrangement is designed in accordance with the demands of Electric Light Men who use meters.

They are supplied with the Terminals at the Top or at the Bottom as desired.

They are supplied with Clock or Cycle Dials.

For Accuracy they cannot be beaten. They catch every passing watt, and add it faithfully to the reading on the plain legible dial. It matters not whether the wave has a hump on its back, or is sway-back, or whether the current is trotting along in arm with the voltage or whether it is lagging behind like the fat wife of a spry husband.

There are thousands of them in use in Canada today, as well as in nearly every country in the world.

Every meter is carefully inspected before being shipped.

We carry large stocks in Toronto and Winnipeg, and can always make prompt shipments.

Ferranti Transformers

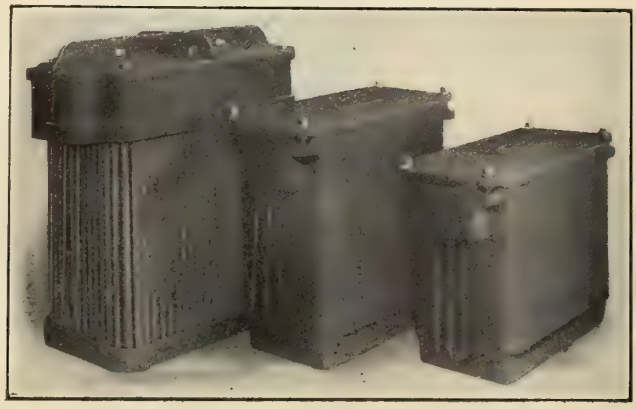
highly efficient at all times.

Of all transformers the three phase type is the most economical to operate and most saving in construction costs.

The efficiency of Ferranti Three Phase Transformers is apparent because of the great reduction in energy loss. The transmission line thus equipped is invariably a profitable one.

All coils are wound by the latest approved methods, thereby reducing losses to a minimum.

We also supply Switch Boards, Motor Panels and Instruments.



THREE PHASE POLE OR STATION TRANSFORMERS.

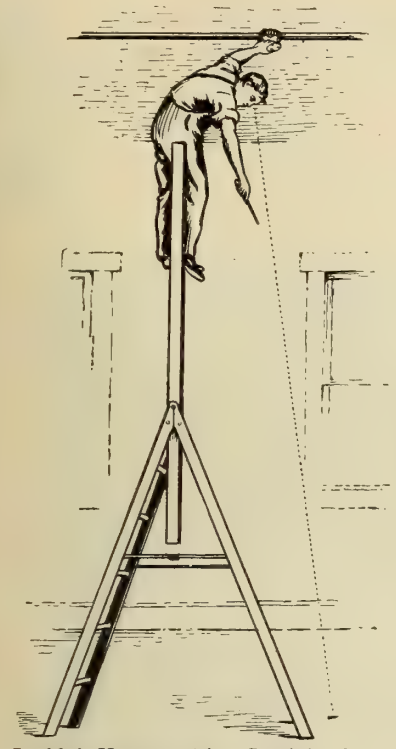
Write for further Particulars and let us make an estimate for you.

The Ferranti Electrical Co.

of Canada, Limited

90 Sherbourne St., TORONTO

56 Albert St., WINNIPEG

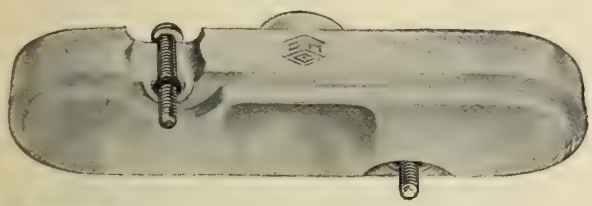


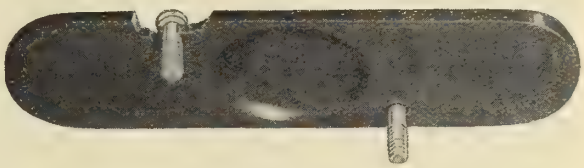
Couldn't Happen with a Condulet Cover

Screws That Can't Fall Out

Users of Condulets Lose No Time Picking Up Fastening Screws for Covers or Conduletto Fittings.

Brass Screws—the Proper Quantity, Size, Shape and Thread—are furnished with Condulet Covers and Conduletto Fittings, and are so secured in screw holes that they ***can't fall out.***







Screw for Porcelains

Screws for Porcelain Covers and Fittings are held in place by formed up fibre washers that engage the screw thread. Washer is put on after screw has been inserted in screw hole, and fits within cup made for it in the porcelain.

Screws for Metal Covers are necked just under the head, and screw holes in covers are tapped. When threading on screw has passed threading in hole, no shaking or knocks can make screw back out.



Screw for Metal Covers

NOTICE—This company has discontinued furnishing cover and fitting fastening screws with Condulets. These screws are now furnished with Condulet Covers and Conduletto Fittings for Condulets.

Crouse-Hinds Co. of Canada, Limited

Main Office and Works:

Toronto, Ontario, Canada

Across Canada with the
IMPERIAL WIRE & CABLE CO.
LIMITED

Toronto - MONTREAL - Winnipeg



Third of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows the McArthur Building, Winnipeg

This building was wired with "30% PARA" Rubber Insulated Wire

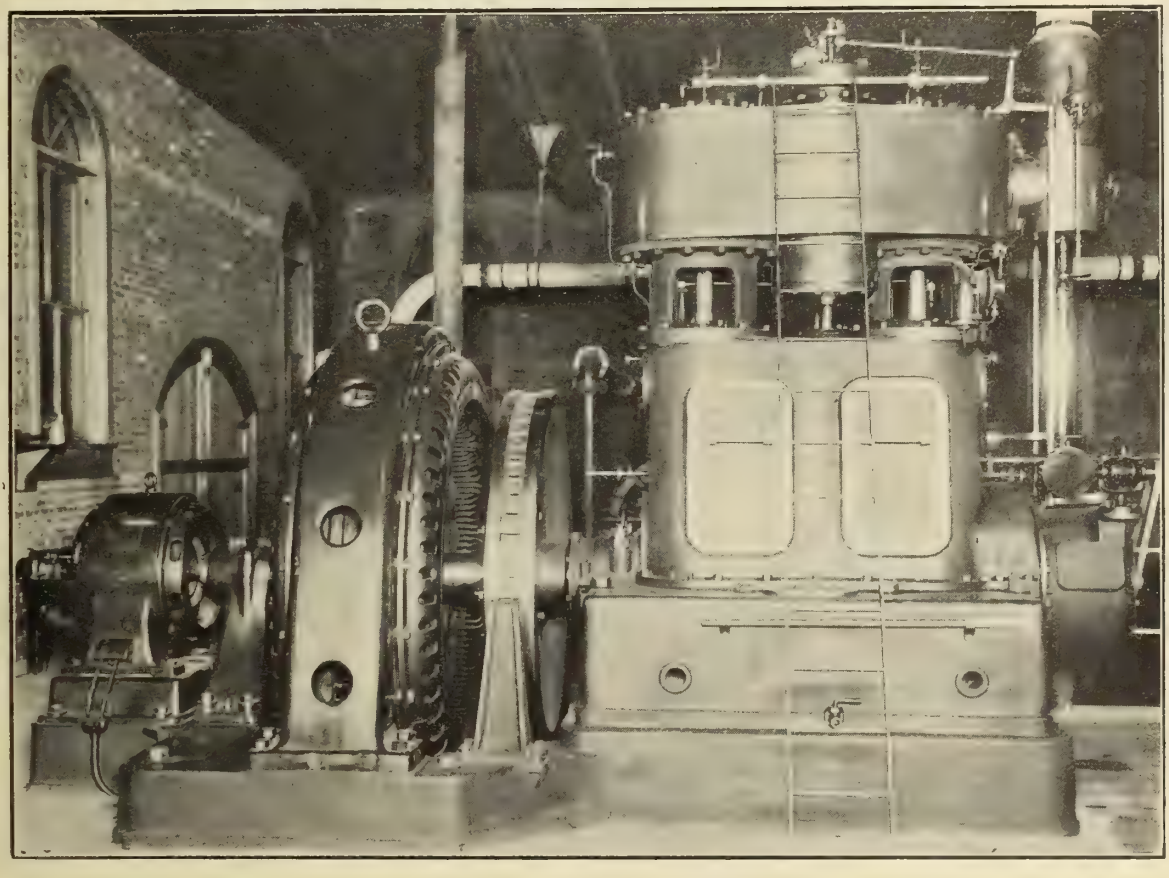
Architect - - - - - J. H. G. Russell, Winnipeg
Engineer - - - Charles L. Pillsbury, Minneapolis, Minn.
Electrical Contractors - Mitchell-Gray Electric Co., Winnipeg

Address enquiries to nearest office—Montreal—Toronto—Winnipeg

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Limited, Calgary and Vancouver.

"ADANAC," "IMPERIAL HIGRADE" and "30% PARA"

High Grade Electrical Apparatus



375 K.V.A. 2300 volt 2 phase 60 cycle 360 R.P.M. A.C. generator direct connected to a Belliss & Morcom high speed engine supplied to the corporation of Wetaskiwin, Alta.

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO

ASEA

Branch Offices: MONTREAL
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CALGARY, ALTA.

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The General Electric Co., of Sweden

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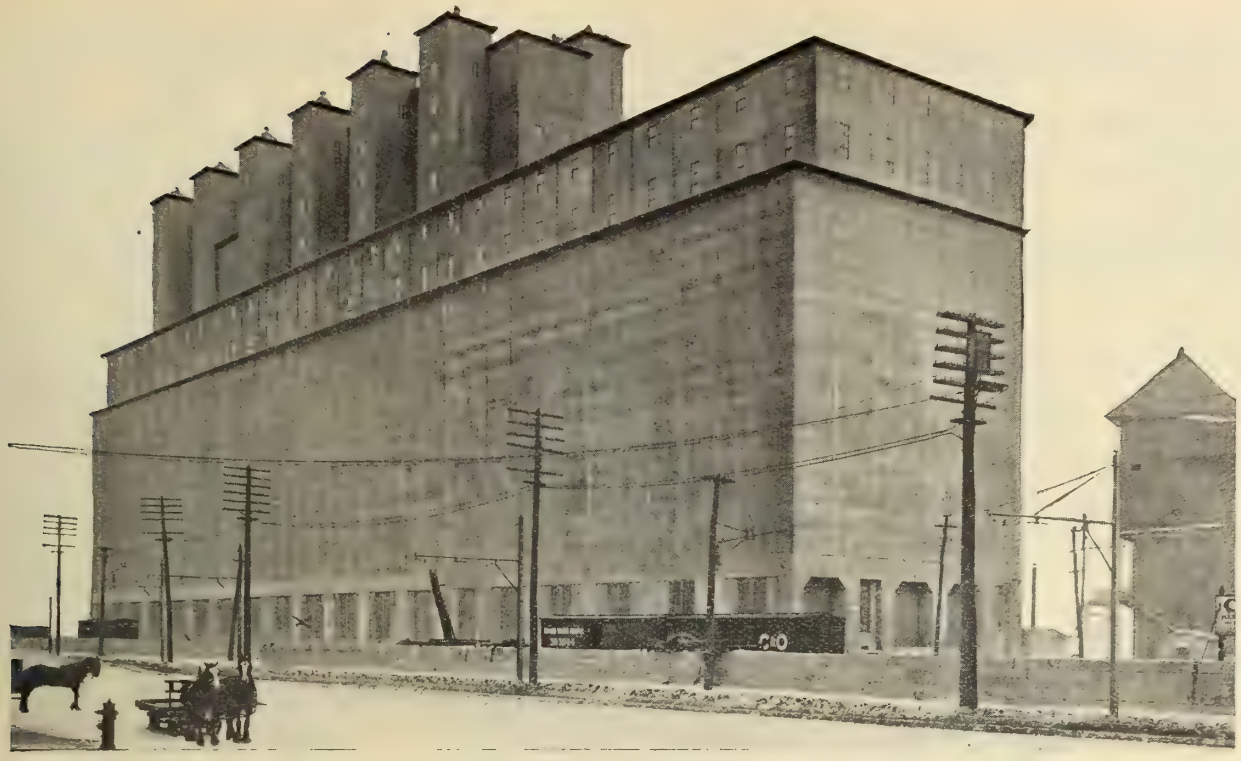
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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers



Harbour Commissioners' Elevator, Montreal
A "Galvaduct" Building.

GALVADUCT AND LORICATED

For the world's largest elevator

The electric wiring throughout this mammoth elevator is carried in Galvaduct and Loricated Conduit.

The world's best conduit for the world's largest elevator.

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated.

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

Conduits Company, Limited

Toronto - Montreal

No meter is better than its slightest defect

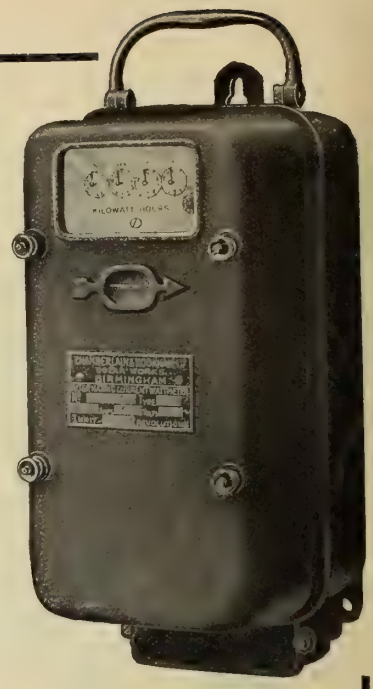
Make us Prove what we say about C & H METERS

Realizing this, we have taken infinite precaution both in designing and in manufacturing C. & H. Meters, to eliminate all possibility of any theoretical or mechanical deficiency. And to make this assurance **doubly sure** each instrument undergoes a rigid and thorough system of testing.

It is our firm belief—a confidence which we are willing to prove at our own expense—that C. & H. Meters, when installed on your lines, will give absolute and lasting satisfaction.

It is this confidence of the manufacturer combined with a high-grade product which makes C. & H. Meters worthy of your investigation.

We will be pleased to supply you with more detailed information.



Polyphase Meter

Chamberlain & Hookham Meter Co., Limited

TORONTO 120 Richmond St., W. Phone M 7791 ONTARIO

Spencer & Aspinall, 617 New Birks Bldg., Montreal, P.Q.

The CANADIAN BRITISH ENGINEERING COMPANY

LIMITED

WINNIPEG BRANCH - 324 Smith St., Winnipeg

Wholesale Electrical Supplies

A large and varied stock carried at our Winnipeg warehouse including

- Wires and Cables
- Conduits
- Conduit Fittings and Boxes
- Switches
- Fuses
- Cutouts
- Sockets
- Receptacles, etc.
- Mazda and Carbon Lamps
- Street Light Fittings
- Telephones
- Bells and Fire Alarms
- Dry Cells
- Secondary Batteries
- Heating and Cooking Devices
- Electric Motors
- Electric Meters

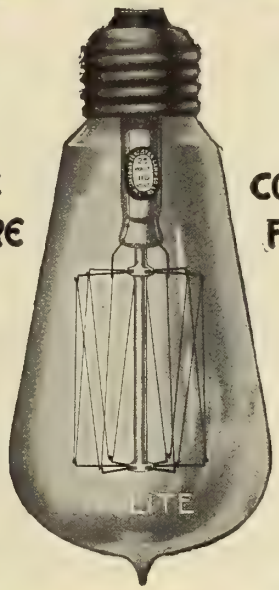
OUR ENDEAVOR

is to ship standard supplies the day order is received

"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE



CONTINUOUS FILAMENT

The Lamp With a Record

—Prices Reduced — —Quality Maintained—

Dealers supplied with their own selling literature as follows; Domestic Circular Letters, Commercial Circular Letters, Factory Circular Letters, General Folders.

Our Lamps and proposition are the best you can get.

Now is the time to make arrangements for your season's stock.

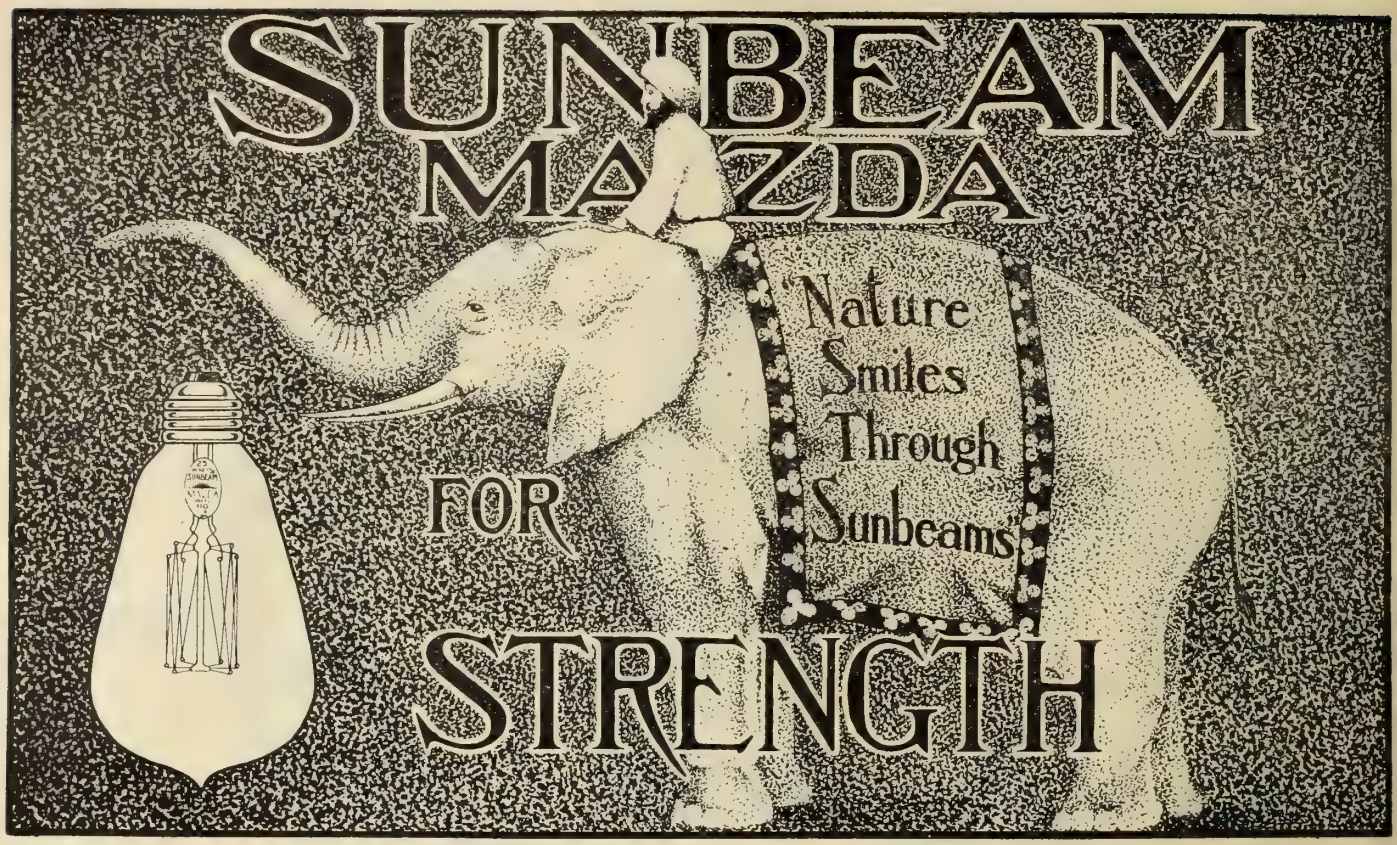
"NULITE" A Canadian Product

manufactured by

THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.
AGENCIES: T. McAvity & Son, St. John, N. B.; Farquhar Bros. Ltd., Halifax, N. S.;
Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto Ont.



A STRONG filament, a bright light and an increased amount of light are advantages to offer your customers if you sell Sunbeam Mazda Lamps.

Three times more light may be had from a Sunbeam lamp as from a Carbon lamp with the same amount of current.

Your Jobber Can Supply You

Canadian Sunbeam Lamp Co., Limited

Main Office and Factory: TORONTO

BRANCH WAREHOUSES:

MONTREAL WINNIPEG CALGARY VANCOUVER

The Question of the Day

with Street Railway men is the Fare-Box —a system which has gained favour wherever tried. The safest box made is the Cleveland. All nuts, screws and bolts are inserted from the inside, and the cash box automatically locks itself when being removed.



The Cleveland Fare Box

is Light, Strong, Durable and Safe. It is proof against theft, and has been adopted by many of the Street Railway Companies in America and Canada.

Cleveland Fare Box Co.

5310 St. Clair Ave., Cleveland, Ohio

SIMPLEX QUALITY

Simplex Quality

means

Simplex Electric Completeness

Attention to the little matters of comfort to the user as well as to the obvious needs of thorough construction, efficient, economical operation, facility and simiplicity in use. For instance:

The "keep hot" rack and the removable doors on the Simplex Toaster.

The "upside-down" attachment by means of which the Simplex iron is adapted to freshening velvet, laces, etc.

The "lock-on" features of cooking utensils which compel economy of heat and prevent utensils from being accidentally tipped over while cooking on the stove.

The push-button connector for detachable cords, removable without friction.

The automatic safety cutout for all devices with self-contained heaters.

The regulator stand (automatic or hand control) for all industrial applications of electric irons.

The cord suspension arm for electric irons.

It is such things as these that help sales and satisfy customers.

The Simplex Electric organization is at your service.

SIMPLEX ELECTRIC HEATING CO.

Mfrs. of Everything for Electric Heating and Cooking

BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. **CAMBRIDGE, MASS.**

SAN FRANCISCO, 612 Howard St.



Butler Bros. *Chicago*

Another Mammoth Firm Installs the Eye Comfort Lighting System.

Indirect Illumination is the light of the future It is here to stay.

Many contractors and supply men realize this opportunity and are making big profits as a result. Central Stations are quick to grasp its advantages.

Which is then the most efficient and most economical system? Which is scientifically designed by engineers to produce perfect lighting, and which has been marketed merely to get some of the profits to be made by selling unscientific and inefficient equipment to a public who has not the knowledge to judge intelligently?

Which system shall **you** advocate?

We say to you:—

That the Eye Comfort Lighting System was installed by the Curtis Publishing Company at Philadelphia (1,000 fixtures) after a sixteen months' investigation; Armour & Company equipped their entire five-storey building (900 fixtures) after eight months of testing. Butler Brothers, shown above, light their offices and sample rooms (1,700 fixtures). Boys High School, New Orleans, is installing 1,200 fixtures. The world's largest men's wear store, The Hub, Chicago, is lighted by it throughout (eight stories). The International Harvester Co. has installed 350 fixtures; Sears Roebuck & Co., 700; Montgomery, Ward & Co., 250; Goodyear Tire & Rubber Co., 385 fixtures at Akron, besides thirty branches; and so on.

Millions of capital says "it is the best system, barring none!" This after exhaustive tests costing thousands and much time.

We cannot offer you stronger proof. We know of no more positive proof you can give your customers. Acquaint yourself with the Eye Comfort Lighting System. It is sold by Canadian jobbers. Ask for our data book and catalogue.

National X-Ray Reflector Co.

General Offices:
225 W. Jackson Blvd.
Chicago, Ill.

New York Office:
Eye Comfort Lighting Shop
14 W. 33rd. St.

Both well lighted and well illuminated.

There is a distinction



Many stores and offices are well lighted, but poorly illuminated

Office of the Toronto Hydro Electric System.
One of the best lighted and illuminated offices in Canada.

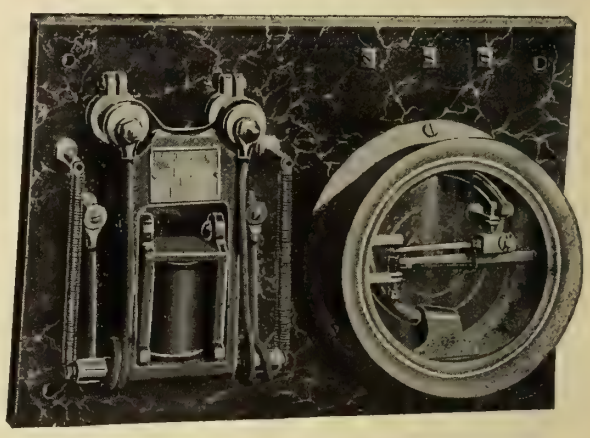
The Holophane Realite promotes greatest efficiency in illumination.
Endorsed by all aggressive and up-to-date central stations.
A big opportunity for live contractors and fixture dealers.

The Holophane Co., Limited, Toronto, Can.

Perfect Pressure Control

Can be obtained in tanks and reservoirs by starting and stopping the motor driven apparatus with

THE SUNDH GAUGE TYPE REGULATOR



The simplest, strongest and most satisfactory regulator made. Operates on a pressure difference of 3 to 5 per cent. of maximum pressure. Wider range may be obtained by screwing down the left-hand screw.

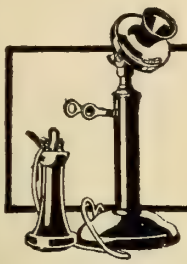
The construction consists of a silver-tipped contact lever attached to the tube and moving between two silver contact points on pressure fluctuations.

The screw on the right is used for adjusting to maximum pressure desired, and the lower screw on left hand is for adjusting for difference in pressure.

Send for "Sundh" catalogue giving complete description of controlling devices for A.C. & D. C.

SUNDH ELECTRIC CO., NEW YORK, U.S.A.

Represented by the **C. H. L. Keeler Co., Ltd., Toronto, Canada**



SAFEGUARD
YOUR SERVICE

THERE are more than 500 telephone "troubles" in Jacksonville every day due to telephone receivers being left off the hook.

Your telephone is reported "Busy" or out of order when the receiver is left off the hook, no one can call you and you are likely to suffer serious inconvenience.

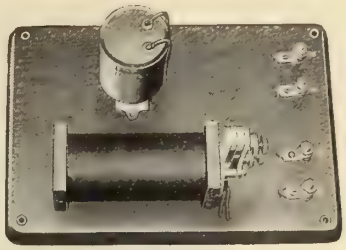
On duplex and party lines all telephones on the line are rendered useless when any one of the receivers is left off the hook.

When you receive a call for a person who answers at an extension telephone, see that your receiver is replaced as soon as the telephone is answered.

Watch your telephone, see that employees are careful to replace the receiver, your service will be improved and you will aid us to increase the efficiency of the service throughout Jacksonville.

May we have your co-operation?

SOUTHERN BELL TELEPHONE
AND TELEGRAPH COMPANY



Safeguard Your Service

BUY A HOWLER

Spare your subscribers and yourself delays due to receivers being off the hook

The Kellogg howler (illustration above) is one of our standard induction coils with interrupter and condenser mounted on a nicely finish, oak panel.

It can be screwed up on the wall or set horizontally on a table or on the switchboard.

It is connected to the line through cord and plug at the board. Simply insert the plug in the jack "of the offending party" and work the key. A good lively "howl" is the result. If desired the apparatus can be connected to the wire chief's desk and he can do the signalling without carrying through the board.

Settle this "receiver off the hook" annoyance with dispatch. Buy a howler.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

MAIN OFFICE AND FACTORY: CHICAGO

CANADIAN SALES OFFICES:
DEERING ELECTRIC LIMITED, REGINA, SASK.
HOUSTON & COMPANY, LIMITED, WINNIPEG, MAN.
B. C. HOLST & COMPANY, VANCOUVER B.C.



Sell Them by the Box

Educate your lamp customers to ***buy them by the box.*** An argument that should appeal is the convenience it affords in being able to carry home as many as five lamps in one neat carton, also that by so doing they may always have a few on hand in case of emergency.

Selling them by the box means that you sell five lamps instead of one or two. Think of the increase this makes in your lamp sales.

Fill up your window with these Northern Light cartons. Their attractive design compels attention.

Look for the name— *Northern Light* —etched on each lamp

THE *Northern-Electric*
AND MANUFACTURING CO. LIMITED

Manufacturer of Telephone and Fire Alarm Apparatus and Distributor of Electrical Supplies for every possible need.

Montreal	**Halifax**	**Toronto**	**Winnipeg**
Regina	**Calgary**	**Edmonton**	**Vancouver**

The
Northern-Electric
Sturtevant
is a Great Seller
Mr. Dealer



Built on a simple principle—a Northern Electric motor, direct connected to a Sturtevant Fan. No valve to leak—no diaphragms to dry up—no bellows to crack—no eccentrics or piston rods to get out of order. It gets away from the antiquated and noisy pump idea with its belts, gears and reciprocating parts

NOW IS THE TIME TO LINE UP FOR THE AGENCY IN YOUR TOWN

THE *Northern-Electric*
AND MANUFACTURING CO. LIMITED

Manufacturer of Telephone and Fire Alarm Apparatus and Distributor of Electrical Supplies for every possible need.

Montreal	Halifax	Toronto	Winnipeg
Regina	Calgary	Edmonton	Vancouver





New Code
Rubber Covered WIRES AND CABLES

Manufactured in accordance with the specifications of the National Board of Fire Underwriters.

SPECIFY  **BRAND**

All our new code wire is inspected by the Underwriters Laboratories, Inc., and have their inspection tags attached.

Price list and discounts on application to head office or nearest agent.

Large stock, from which we can make prompt shipments, carried at Toronto, Montreal, Winnipeg and Vancouver.

Canada Wire & Cable Co., Limited

1160-1170 Dundas Street

Toronto, - Canada

Sales Agents:

Roper, Clarke & Co., Limited
Montreal

A. E. Esling, Scott Block
Winnipeg

Macdonald, Marpole Co., Limited
Vancouver

Messrs. Gorman, Clancy & Grindley,
Calgary and Edmonton, Limited





The Best In Material And Workmanship

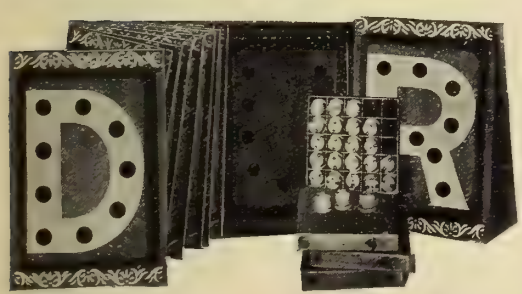
Everything that goes into a Federal Electric Sign is the ***best.*** Quality is the watchword of the Federal Factory —we demand a sign that will keep its attractive appearance under all conditions, no matter how severe. The colors are not painted, they are porcelain enamelled and will retain their brilliancy for a lifetime. The sign is effective by day as well as by night.

Federal Electric Signs Are Everlasting

From the frame up, Federal Electric Signs are built entirely of metal, carefully constructed by sign experts. The letters are stamped separately from sheet steel and porcelain enamelled inside and out. Each letter is then firmly screwed to the galvanized channel iron frame. The chains and hanging rig are heavily galvanized and the sign is absolutely rust proof. The lamp sockets are moisture proof and the entire sign is approved by the Underwriters' National Electric Association.

Central Stations—Write for Bulletin 27111

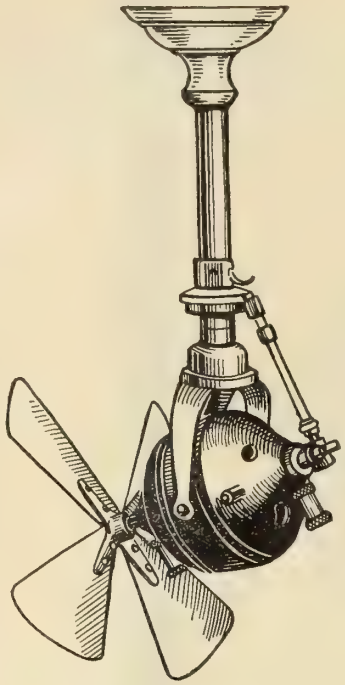
Federal Signs Sold F.O.B., Factory, Hamilton, Ont.



Trade Mark

Federal Sign System (Electric)

640 W. Lake Street,
Chicago, Illinois



CEILING FAN
(Self Rotating)

The Fan Season is Now Here

FANS LEAD ALL OTHERS

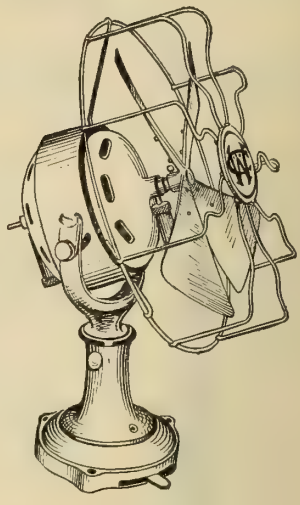
C & W fans are attractively designed and noiseless in operation.

C & W oscillating fans are the neatest and most perfect on the market.

C & W Self Rotating ceiling fans are much superior to anything heretofore offered.

You will be asked for C & W Fans.

Write us for catalogue and prices.

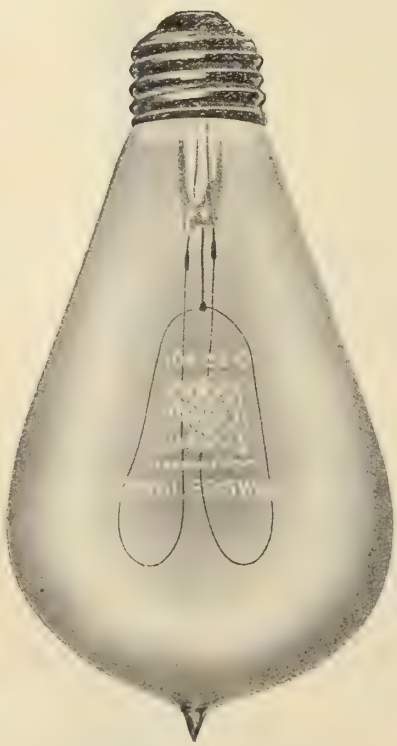


DESK FAN
(Oscillating)

CHAPMAN & WALKER, Limited

118-120 Richmond St. W., TORONTO, ONT.

VANCOUVER WINNIPEG MONTREAL



No. 21 Bulb, 50 C. P.

We are sole Canadian agents for

"ROYAL EDISWAN"

CARBON FILAMENT LAMPS

In the manufacture of the "Royal Ediswan" Carbon Lamp, the makers have spared no effort to perfect a product of superior quality and maximum efficiency.

Those among your customers who prefer the carbon filament lamp will find the "Royal Ediswan" a satisfaction which comes only from a high-grade product.

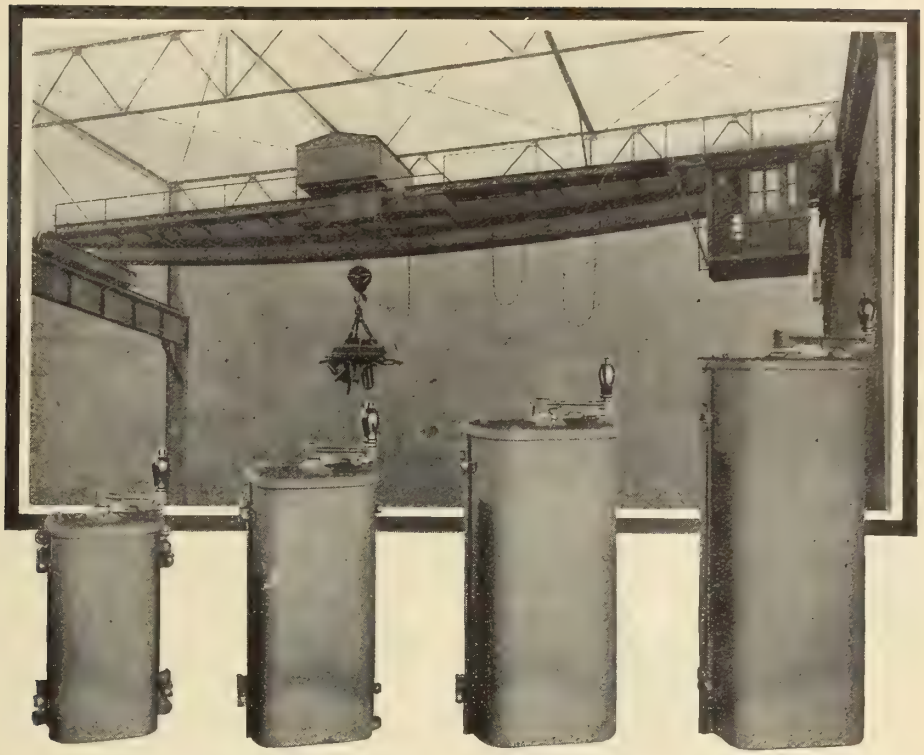
Made in standard American bulbs, (also fancy bulbs) and built to standard specifications.

We are prepared to make prompt shipments on all orders—large or small.

Chapman & Walker, Limited

TORONTO 118-20 Richmond St. W., ONTARIO

MONTREAL WINNIPEG VANCOUVER



CUTLER-HAMMER

Drum Type Controllers

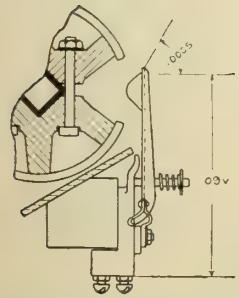
Cutler-Hammer enclosed drum type controllers for crane and hoist service are not new,—they have been in successful service for nearly two years. The success of these controllers has made the enclosed type controller popular.

It is possible to imitate some features of these controllers but there is no copying of Cutler-Hammer experience and specialized engineering service.

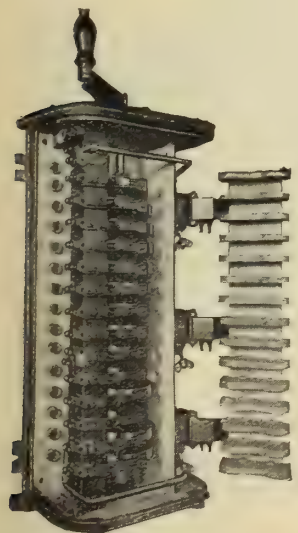
Cutler-Hammer engineers have developed all features of the enclosed drum controllers, step by step;—the straight non-stubbing fingers are so designed as to insure smooth uniform contact with the contact segments; the rotary motion is easy and smooth; powerful magnetic fields obtain a blowout on every finger and segment; and the tight fitting drum prevents accidents.

We know the reason for each feature and detail of the controllers because we developed them and the two years in which they have been in service have proven them right.

Cutler-Hammer drum controllers have the original non-stubbing fingers. Bulletins 5300, 5310, 5330, 5340, 5350 and 5360 describe direct current types; Bulletins 9350, 9360 and 9365, alternating current types. Shall we send these to you Just let us have your address.



Details of Cutler-Hammer Drum Controller Contacts



Interior of Controller showing the original Straight Non-stubbing Fingers.

The Cutler-Hammer Mfg. Co.

Milwaukee, Wisconsin

NEW YORK: Hudson Terminal, 50 Church St. CHICAGO; Peoples Gas Bldg.
PITTSBURG: Farmers' Bank Bldg. BOSTON: Columbian Life Bldg.
PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Bldg.
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St., SAN FRANCISCO: 229 Sherlock Bldg., PORTLAND, ORE., and W. B. Palmer, 416 E. 3rd St., LOS ANGELES.

Moonstone Glass



4054—60 Watt



4052—40 Watt



4050—25 Watt



4056—100 Watt

The Sanitary Reflectors here shown were especially designed for Hospitals. There is an entire absence of crevices thus preventing the collection of dust and germs. Another notable feature is that the reflectors can be easily cleaned without being removed from the fixtures. Moonstone Glass was given the preference over all other semi-translucent glasses by the lighting committee of the Toronto General Hospital, on account of its color and efficiency.



4058—150 Watt



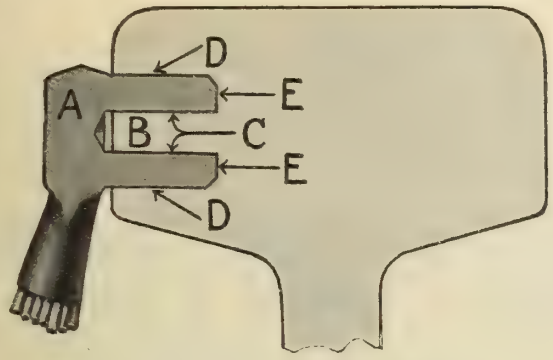
4060—250 Watt

The Jefferson Glass Company *Limited*

MADE IN CANADA

TORONTO CANADA

O-B Type J Bond



Section of Terminal Installed

Many thousands of these Bonds are now in service.

The ease of installing and the permanency of electrical and mechanical contact have caused its adoption on many large roads.

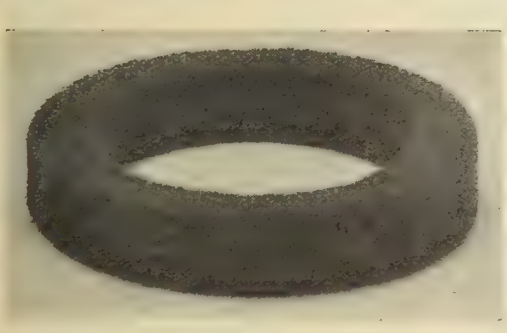
Details on request.

The Ohio Brass Co.

Mansfield, Ohio, U.S.A.

Booth

Mechanical Felt Goods



At Gananoque, Ont., we have the dies, the plant, the felt, the men and the experience to turn out mechanical felts that are cheaper and better than can be obtained from any other source.

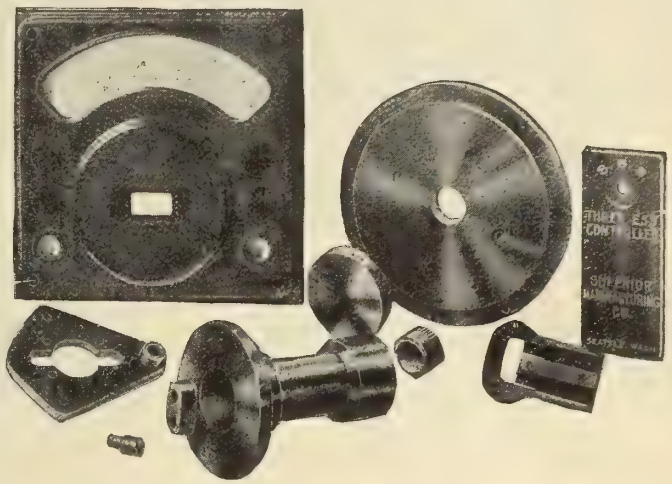
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J-P Bakelite has many qualities not possessed by hard or vulcanized rubber or any other molded insulating material.

This insulation is especially adapted for the molding of complicated shapes. It takes a very high finish and retains its finish permanently under all atmospheric conditions.

Its high dielectric strength, 250 volts per mil—its great mechanical strength—its resistance to heat up to 300 deg. Fahr. and its non-absorptive qualities, are additional features which should appeal to the manufacturer of devices requiring a particularly high grade molded insulation.

Ask our nearest branch for sample and further particulars.

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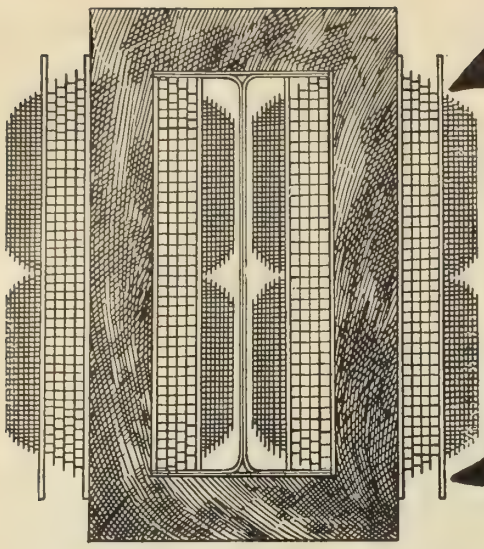
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High Insulation

A FEATURE of vital importance to the economical operation and upkeep of a transformer is the insulation. It must be the best quality material applied in the most efficient manner.

The illustration shows a sectional view of a Moloney type H.E. transformer. Note the manner in which the insulation between the primary and secondary extends beyond the end of the coils, also the insulation between the primary layers extending beyond the outside turns.

Moloney transformers are the best in every detail of design and workmanship.

Our Catalogue contains much valuable information

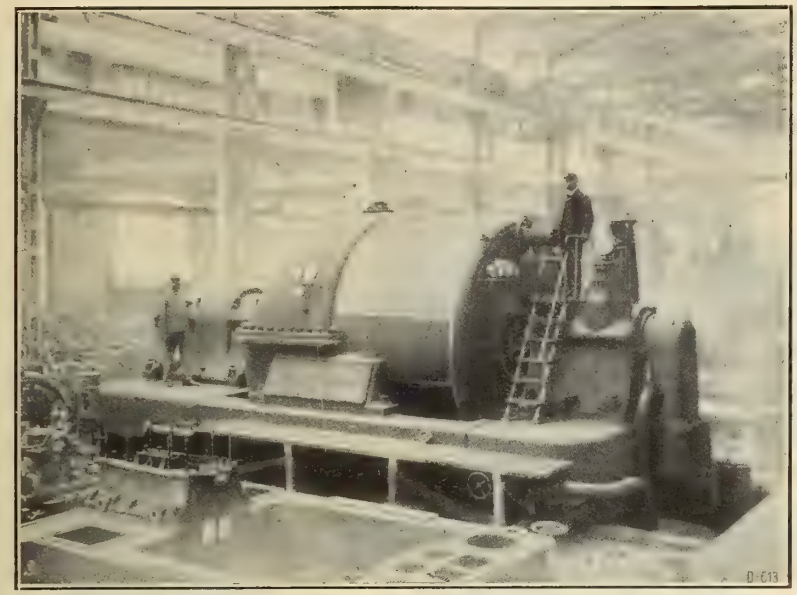
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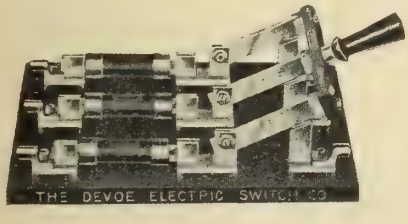
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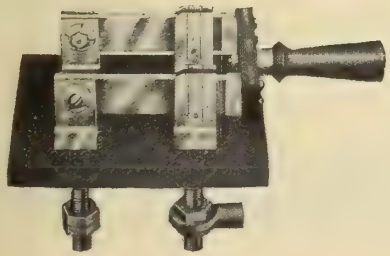
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Manufacturers

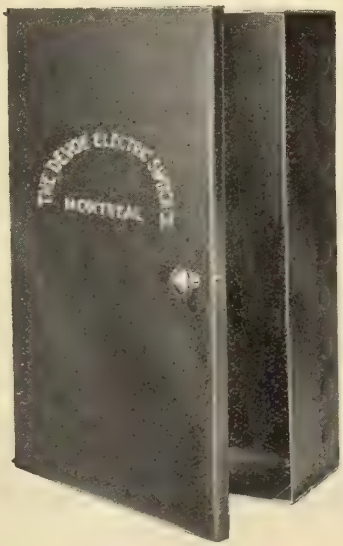
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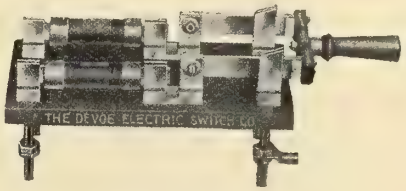


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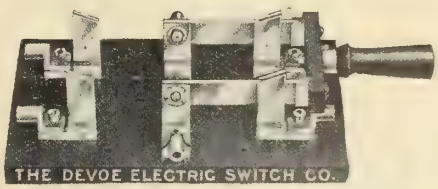


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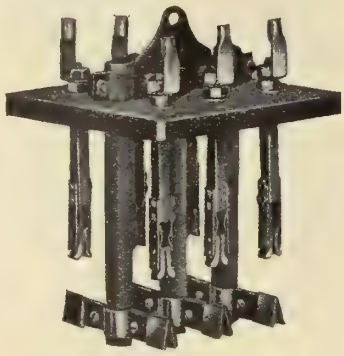
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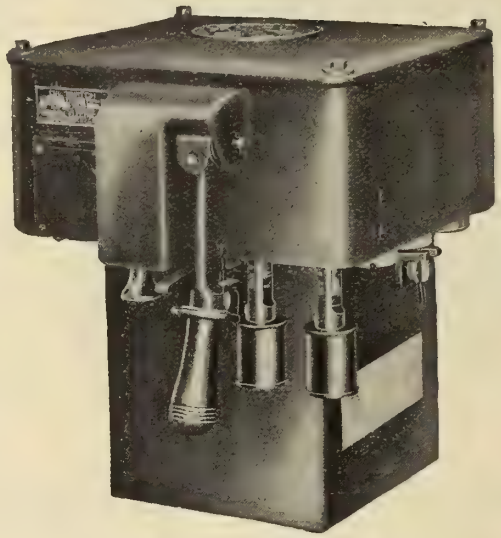
The New K 20 Oil Switch

—What it means to the Plant

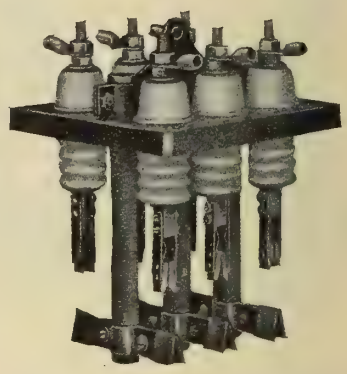
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Contacts, insulation and terminals for 600-Volt Switch.



Type F. Form K-20 Oil Switch complete with automatic overload and low voltage release.



Contacts, insulation and terminals for 2500-Volt Switch.

The C. G. E. "K-20" Oil Switch was designed specifically to meet the exacting conditions which are experienced in textile and flour mills, woodworking plants, powder works, coal mines, gas works, oil refineries or in any industry where there are inflammable materials or explosive gases.

It is ***simple, compact*** and ***durable.***

It is entirely enclosed and perfect in every single detail.

Made in capacities up to 300 amperes and 2500 volts and can be furnished with different combinations of automatic tripping devices to meet a wide variety of operating requirements.

Complete information and prices are given in Bulletin 4911, a copy of which will be gladly supplied upon request.

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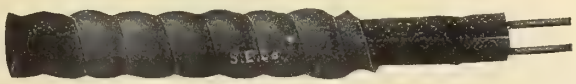
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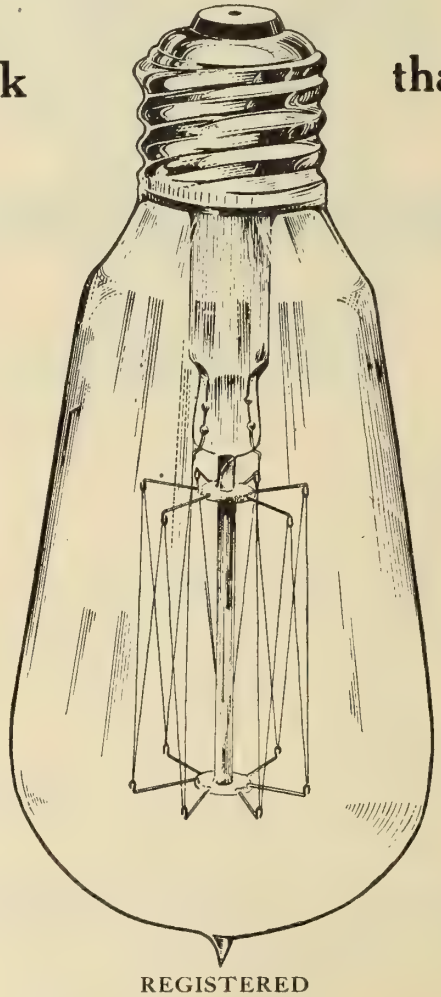


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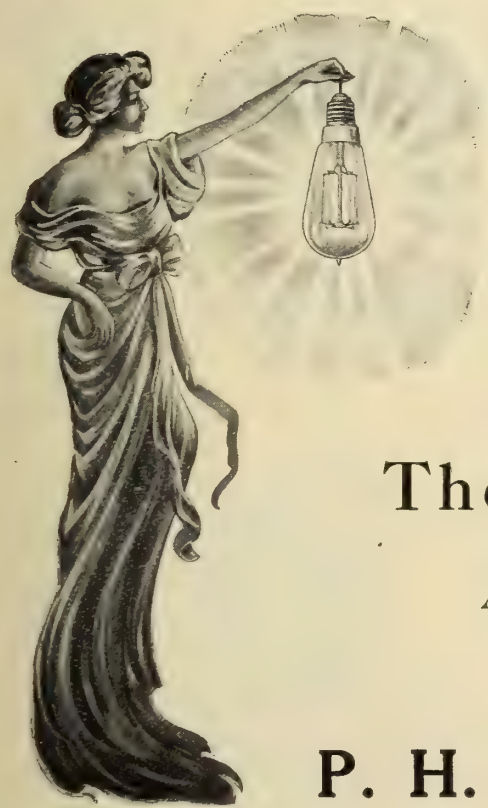
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There's **your** guarantee, —the trademark which we back up all along the line.

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CONSOLIDATED TUNGSTOLIERS

Something New in Fixtures

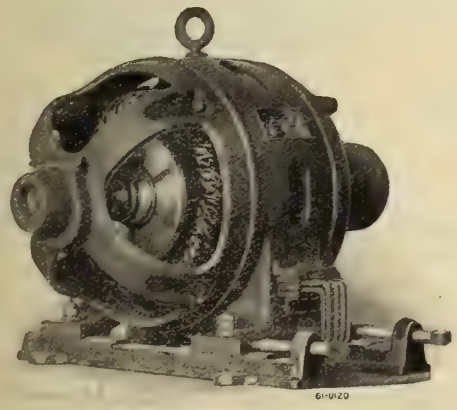
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The Tungstolier Company of Canada Limited
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'The Public Servant'

THE WAGNER POLYPHASE MOTOR
with
NO STARTING DEVICE REQUIRED



HIGH STARTING TORQUE
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ABSOLUTELY SELF STARTING
UNDER HEAVY LOADS
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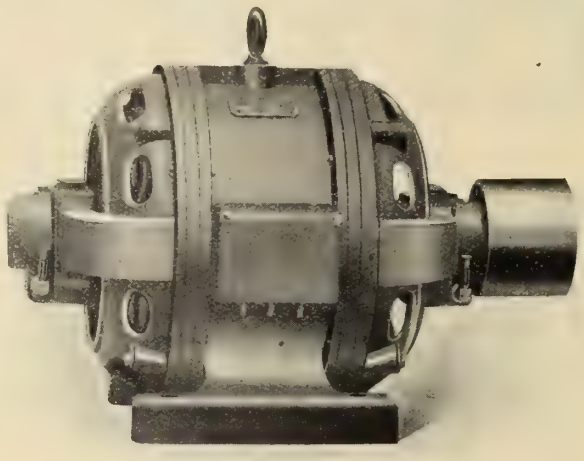
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Sound Mechanical Construction and Smooth Running

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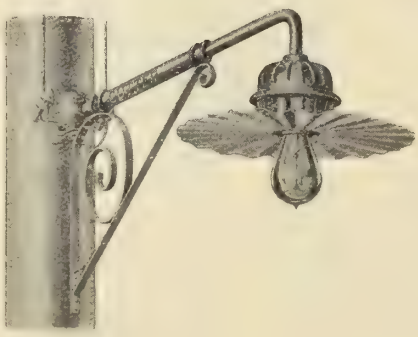
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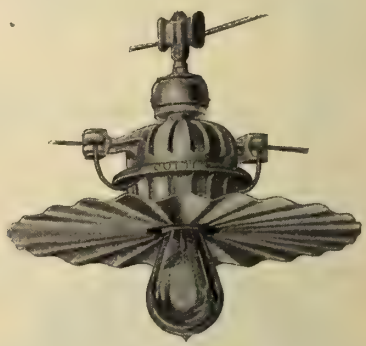
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CUTTER STREETHOODS



Cutter Boulevard Telescope Bracket with One-Piece Fluted Streethood.

Substantial Construction
High Insulation
Easy to Install
Artistic Appearance



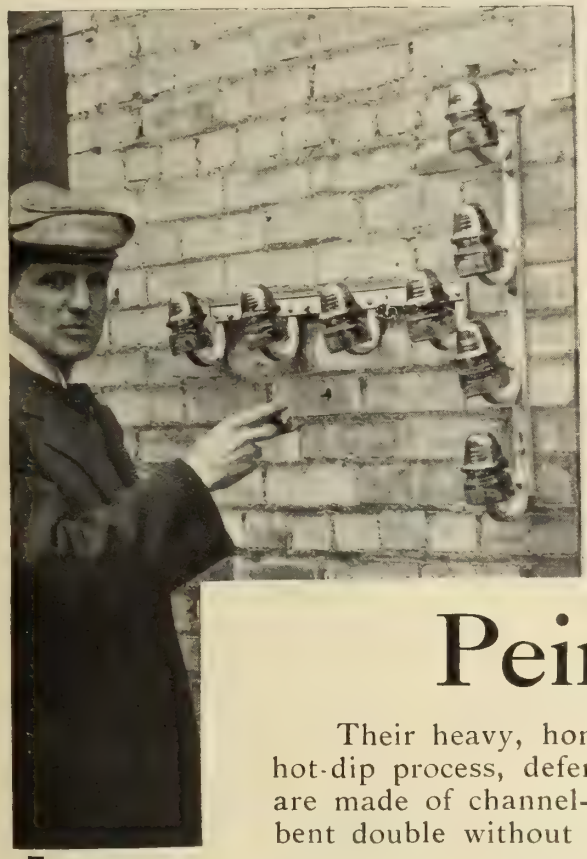
Style G—High Voltage Cable Grip Suspension Streethood.

The body of our new type streethood is a reinforced porcelain insulator designed to receive series or multiple sockets. The fluted steel reflector is fire enameled—blue on top and white on the reflecting surface.

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Their heavy, homogeneous coating of pure zinc, put on by the hot-dip process, defers corrosion to the dim and distant future. They are made of channel-section, hot-rolled open-hearth steel and can be bent double without fracture. All Peirce Brackets are fitted with

Peirce Spring Threads

which allow perfectly for expansion, contraction and inequality of bore, yet always hold the insulators securely.

For attaching Peirce Brackets to brick, stone or concrete walls, the "one best bet" is the



Peirce Hammer Drill and Peirce Expansion Bolts

The Peirce Hammer-Drill will drill a hole an inch deep in solid brick in less than a minute. It takes various sizes of drill points, which can be quickly removed for sharpening. Its reverse end is a hollow punch for upsetting the lead sleeves of Peirce Expansion Bolts—it forces the soft lead into every crevice of the brick. When properly installed, Peirce Expansion Bolts will pull off the face of the brick before letting go.



Peirce Specialties and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.



The Hardware MAKES the Line, Hubbard Makes THE Hardware

Hubbard and Company, Pittsburgh, U.S.A.

"It Watches The Pole"

That's the whole business of the Keystone Trolley Catcher. Just as surely as the pole leaves the wire, just as surely is it caught and *held* by the Keystone Catcher.

And that's why they eliminate the banging of your overhead and cut down maintenance charges.

Study the illustration showing the centrifugal pawl—the business end of the Keystone Catcher—in action. Note the simplicity of its entire construction; its ruggedness; its strength; its few parts; its "fool-proofness." And with all this, their unique construction means that Keystone Catchers *will not rebound* and allow the pole to climb.

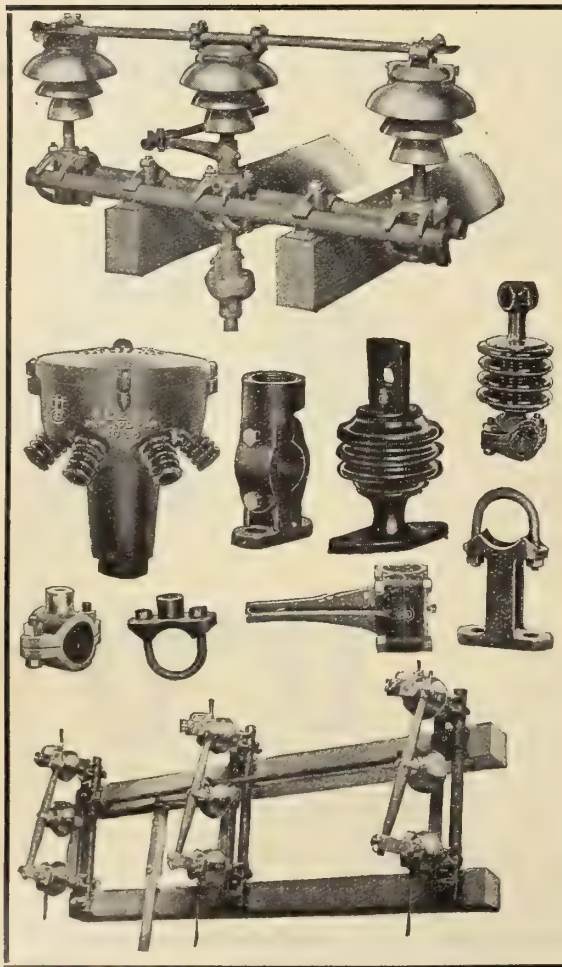


Section View of Keystone Catcher Showing Position of Centrifugal Pawl After It Has Locked the Catcher.

Don't run your cars without Keystones. *Prove* their economies by getting one or two for 60 days' trial on your own property. You place yourself under no obligation whatever in accepting this offer.

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Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, September 1, 1913 No. 17

Present Hydro Extensions

That the extension demands on the Hydro-electric Power Commission of Ontario are showing no signs of abatement is indicated by the quantity of construction work at present under way at different points in Ontario. In the south-west section, the work includes capacity extensions at the Niagara Falls step up transforming station, the base of supplies, from the original 50,000 to about 75,000 h.p.; additions to the main switching station at Dundas, made immediately necessary by the requirements of the new St. Thomas to Windsor territory; additions also to the London and St. Thomas stations and the construction of new step-down sub-stations at Chatham and Windsor. For the two latter the equipment has been under construction for some months and the contracts for the buildings will be let in a few days. Work on the Brantford sub-station is also nearing completion. Line work in progress includes stringing the second circuit along the towers between Dundas and St. Thomas by way of Brantford and the construction of a new double circuit line between St. Thomas and Windsor. It will be remembered that the original towers between Dundas and St. Thomas were designed for a double circuit, but up to the present time only one circuit has been installed. The second circuit now being run from Dundas to St. Thomas is of aluminium cable, steel cored, this being the first instance of its use in Canada, though this type of cable has proven itself reliable over several years' operations in the United States. Between St. Thomas and Windsor the high tension line will be of copper. Considerable progress has been made on the new line west of Chatham, the tower footings being nearly all in place. When this section is completed the entire force will be set to work between Chatham and St. Thomas. All this work is being done by the Commission, no contractors being employed.

A 26,400 volt line is also being run out from Stratford to feed Clinton and Goderich where sub-stations are at present under way.

That the Commission has been able to carry on this work with undiminished vigor and at the time time take care of the frequent troubles it has recently had with its defective insulators, speaks well for chief engineer Gaby's organization. Since the beginning of the trouble, insulators on practically the whole line have been tested, and where necessary, replaced. In this connection it is interesting to note that the Commission's engineers have devised an apparatus for testing the insulators in service. This is an exceedingly valuable innovation in the matter of line testing, and we understand it is the Commission's intention to keep this testing equipment continuously at work on the line. This should go a long way towards preventing a recurrence of the insulator troubles which have bothered so many systems during the present summer.

In Eastern Ontario where power has been purchased from the Morrisburg Light & Power Company, a 25,000 volt transmission line is nearing completion to Prescott, 22 miles distant, and a sub-station of about 1,000 h.p. capacity is being erected at Preston.

In the Severn district a hydro-electric installation at Wasdell's Falls will be completed with all reasonable haste to supply the towns and villages in that neighborhood.

In addition to this, railway schemes and many other distribution extensions are either in course of erection or are being considered by the Commission's engineers. To all appearance there is little sign of any let-up in this Government undertaking. The total load is increasing quite beyond the expectations of the most sanguine of the original supporters and the demand threatens to become so urgent in the near future that in all reasonable probability the original contract for a maximum of 100,000 h.p., which looked so impossible five years ago, will have become a necessity.

Illustrated Articles

The matter of the best type of illustrations to reproduce in connection with the various descriptive articles in trade magazines is one which possibly permits of discussion, but the Electrical News is of the opinion that photographs of a purely pictorial character, so generally used, have much less educative value than, for example, plans, diagrams, etc., which indicate, in some part at least, the point of view of the designing engineer, the difficulties to be overcome and this particular engineer's method of overcoming them. Pictorial reproductions, such as the exterior of a building, or a too complicated interior are almost without value for educative purposes. The use of such a large number of this type of illustrations is accounted for, doubtless, by the fact that they add to the good appearance of articles which, further, are often written by men who are more or less closely associated with the installation being described and so, from their very familiarity with the equipment, see much more in the pictures than the readers of the articles can hope to. Or again, a reproduction of a switchboard, back or front, or a layout of generators or motors may show a "pretty" piece of work of the author himself which naturally he likes to see published, however complicated the work, or poor the photograph, may be.

In endeavoring to keep the helpful and educative features more and more prominent in our pages the Electrical News commends the above suggestions to the consideration of its readers and especially to all those who contribute items or articles for reproduction. The more practical the ideas are, the more value they will have for other electrical men. The Electrical News aims to be more than a "news" medium. Through our own efforts and our readers' assistance we hope

to make our magazine increasingly valuable as a medium of reliable "information" on all electrical matters.

Amendment to Regulations

An amendment to the regulations governing the granting of water power rights in Dominion Forest Reserves and parks has just been passed by an order-in-council giving power to the Minister of the Interior to lease water-powers which have a development of not more than 200 h.p., the leases to run for ten years, but renewable at the discretion of the Minister. The object of amending the regulations is to allow farmers, private householders, or owners of a small sawmill or such like to harness small waterfalls in the district in which they live, for the development of electric power. The order-in-council as passed reads as follows:

Whereas water power regulations governing the mode of granting water power rights in the provinces of Manitoba, Saskatchewan and Alberta, and in the Northwest Territories, were approved by Orders in Council dated 2nd June, 1909, 8th June, 1909, 20th April, 1910, 24th January, 1911, and 12th August, 1911, and these regulations were, by Order-in-Council dated 6th June, 1911, made applicable to all Dominion Forest Reserves and Parks;

And whereas these water power regulations are not suitable for the authorization of small water power developments of less capacity than 200 horse-power;

And whereas there are many applications before the Department of the Interior for the right to develop such small water powers,—

Therefore His Excellency the Administrator in Council, pursuant to subsection 2 of section 35 of The Dominion Lands Act and to subsection b of section 17 of the Dominion Forest Reserves and Parks Act, is pleased to order that the present Water Power Regulations, hereinbefore referred to, shall be and the same are hereby amended by the addition of a new section numbered twelve (12) as follows:—

(12).—If upon receipt and consideration of the information set out in sections 2, 3, 4 and 5, the water power to be developed is found to have no greater capacity than 200 horse-power at the average low stage of water, the Minister may issue a lease and a license, as may be required, authorizing the development of the proposed power; the lease and license to be for a period of ten years, subject to such special terms and conditions as may be considered advisable in each particular case ,and renewable if in the opinion of the Minister the power has been continuously and beneficially used.

Underground Work at Ottawa

The Department of Public Works, Ottawa, Ont., have called for tenders for underground services for the Parliament Buildings, Eastern and Western Blocks, and Supreme Court, Ottawa, which is to include vitrified clay conduit, hand holes, man holes, iron pipe, cable, cable racks, pot heads, junction boxes, etc., and everything necessary to insure a complete underground system. Four-duct conduit are to be installed, extending from a manhole now installed on Wellington street opposite the east gate around Parliament Hill to Bank street, with manholes and handholes. Ducts are to be laid at least 18 inches underground and enclosed in concrete at least 3 inches thick. Each joint is to be protected so that the concrete cannot filter through. Where the ducts are carried over the cliff at Supreme Court they are to be installed on a concrete bed at least three inches thick and enclosed in concrete of the same thickness.

The manholes are to have concrete sides at least eight inches thick and to have at least 5 feet 6 inches head-room. Handholes must have 5 inches concrete sides and be provided with metal covers checked into concrete, grouted with concrete, and made air-tight. Two stranded copper, paper insulated, lead covered cables are to be furnished and installed complete for main circuits; one 4-core, No. 2/0, B & S gauge for 2-phase a.c. circuits and one 3-core 300,000 c.m. for d.c. service. Branch cables for a.c. are to be 4-core, No. 4 B & S gauge, stranded copper, paper insulated lead covered; branch cables for d.c. to be 2-core, No. 3/0 B & S gauge, stranded copper, paper insulated lead covered.

Main and branch cables are to have paper insulation not less than 5/32 of an inch thick and lead sheath not less than 3/32 of an inch thick and must withstand a shop test pressure of 8,000 volts for thirty minutes. Alternative current cables must be designed for a working pressure of 3,200 volts; d.c. cables for 600 volts. The main cables in the manholes are to be connected to branch cables through an approved junction box to be furnished by the Department.

Report on Stream Measurements

The third of a series of reports on the progress of stream measurements in the provinces of Saskatchewan and Alberta, covering the year 1911, has just been distributed by the Department of the Interior. The report has been prepared under the direction of Mr. F. H. Peters, C.E., Commissioner of Irrigation, by Mr. P. M. Sauder, C.E., chief government hydrographer.

The chief features of the stream-measurement work are the collection of data relating to the flow of the surface waters and a study of the conditions affecting this flow. Information is also collected concerning the river profiles, duration and magnitude of floods, irrigation, water-power, storage, seepage, etc., which may be of use in hydrographic studies.

This information is obtained by a series of observations at regular gauging stations which are established at various points. The selection of sites for these gauging stations and their maintenance depend largely on the physical features and needs of the locality. If water is to be used for irrigation purposes the summer flow receives special attention; where it is required for power purposes, it becomes necessary to determine the minimum flow; if water is to be stored, information is obtained regarding the maximum flow. In all cases the duration of the different stages of the streams is noted. Throughout the country gauging stations are maintained for general statistical purposes, to show the conditions existing through long periods. They are also used as primary stations, and their records in connection with short series of measurements will serve as bases for estimating the flow at other points in the drainage basin.

As the result of an increased appropriation the investigations were extended over a much larger territory during the past year. Considerable reconnoissance work was done and a number of new gaugaing stations were established. In the spring of 1911, field operations were commenced with 98 regular gauging stations and at present the regimen of flow is being studied at 132 regular gauging stations along the various streams in Alberta and Saskatchewan, records of the quantity of water diverted by thirty ditches for irrigation purposes are also being secured. Most of the stations on ditches were established by or at the request of the irrigation inspecting engineers. Winter records which are so valuable for power investigations have been given considerable attention lately and records have been secured on almost all the important streams in the two provinces during the past winter.

The methods of carrying on the investigations were similar to those of previous years. Local residents were engaged to observe the gauge-height at regular gauging stations. These observations were recorded in a book supplied by the Department, and at the end of each week the ob-

server copied the week's records on a postcard which was sent to the chief hydrographer by the first convenient mail. The district hydrographers made regular visits to the gauging stations usually once in every three weeks. They examined the observers' records, made discharge measurements and collected such information and data as would be of use in making estimates of the daily flow at the station. The results of the gaugings were transmitted by a postcard to the chief hydrographer. The records of the gauge-height observers and the hydrographers were copied from the post cards to regular forms in the office at Calgary and filed. At the close of the open-water season, part of the engineers returned to the office and assisted in the final computations and estimates of run-off. Gauge-height-area, gauge-height-mean-velocity, and gauge-height-discharge curves were plotted and rating tables constructed. Tables of discharge measurements, daily gauge-height and discharge, and monthly discharge were also compiled. These records have been recopied and are embodied in this, the third annual report of progress of stream measurements. The report also contains a number of interesting illustrations.

The World Wants This Man

By Berton Braley

We seek him everywhere
Amid the throng.
We've sought him here and there
And sought him long,
Hoping among the mob
He'll chance to dwell—
The man who knows his job
And does it well!

We know of labor's woes,
Nor hold them light,
But ah, the man who knows
His business—right!
Workman, or cop, or clerk—
He makes a hit,
The man who knows his work
And tends to it!

The world has constant use
For men like this.
Who's work's not fast and loose
And hit or miss.
It seeks, with heart athrob,
Where he may dwell—
The man who knows his job
And does it well.

The Conservation of Our Water Powers

The Commission of Conservation have just issued their fourth annual report on the progress of investigation into the natural resources of our Dominion. The report includes contributions by Mr. Leo. G. Denis and Mr. Arthur V. White concerning work done by them in connection with the collection of water power data at different points in Canada. These latter reports are written in the form of a condensed diary which makes almost as interesting reading as the log-books of Stanley, Nansen, Shackleton, Scott, and other explorers of unknown regions. The only difficulty is that the information is as yet too meagre. There is enough, however, to indicate that the work of these engineers is along lines which are certain to give, ultimately, valuable and far-reaching results, showing that the Commission have been well advised in the type of work they are undertaking. That the results will come slowly is only to be expected, as the field of investigation is large, the work is onerous, and the funds available are not unlimited. Apparently however, the government is prepared to deal fairly liberally in the latter respect, a course with which we entirely agree, for, quite aside from the immediate monetary value of accurate knowledge about our water powers, the definite assurance of their actual magnitude will give our Dominion a considerable added prestige among the other nations of the world. Copious extracts from the reports of Messrs. Denis and White are printed elsewhere in this issue.

Electrification of New Birks Bldg.

A Description of the Equipment in Vancouver's Handsomest Office Building

When completed the Birks Block, Vancouver's newest and handsomest office building, situated at the corner of Georgia and Granville streets, will possess electrical equipments superior to any previously installed in a local building of this class. The structure on its two street frontages measures 100 x 120 feet, and comprises 10 storeys with a basement and sub-basement. The sub-basement is utilized for the heating plant which consists of two high pressure boilers burning oil fuel. The basement, ground floor and about three-quarters of the space on the first floor will be occupied by the well-known jewelry firm of Henry Birks & Sons, Limited. The firm's show rooms, packing rooms, buyers' rooms, optical grinding department, large transformer room and lockers for employees are all contained in the basement. The retail jewelry premises will occupy the entire ground floor space, the watch repairing department, jewelry manufacturing and repairing department, mailing room, men's lockers, women's lockers and rest rooms being located on the first floor.

The floors above the first storey will be used for general offices of various dimensions. The light and power throughout the building, which will be supplied by the B. C. Electric Railway Company, consists of 500 volts d.c. and 220 volts, 3-phase and 220 and 110 volts single phase. The 220 and 110 single phase will be used for lighting purposes, while the 220 volt, 3-phase will take care of the power supply, exclusive of the current required for the elevators, four in number, which will be operated by 550 volt d.c.

The wires for the lighting service consist of nine 700,000 c.m. cable in three pairs of three each, in three separate runs placed in 4-inch conduits, and the power service is two 300,000 c.m. cable. The 3-phase is made up of three No. 4/0 cable.

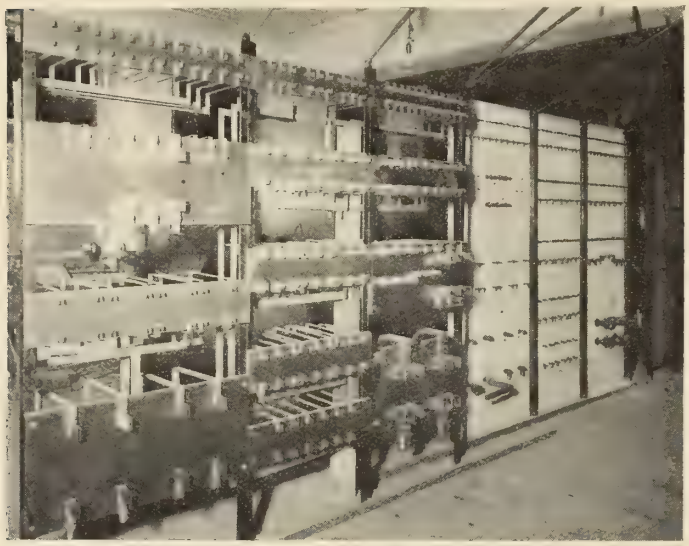
The switchboard controlling the light and power was manufactured by A. R. Coutts & Company, Vancouver. The width of the board is 9 feet, 7 inches, and the height 7 feet. There are three panels of blue Italian marble, consisting of two lighting panels and one power panel The switches are all back connected, and the fuses and buzzing equipments are mounted on a separate rack, which is set 18 inches from the rear of the marble panels. All conduits terminate in a concrete pit at the back of the switchboard, and the wires are carried to the various switches on the board in such a manner as to make them accessible at all times. This concrete pit is drained and has a plate glass covering 1½ inches thick, which covers the entire floor at the rear of the board. The outstanding feature of the latter equipment is the absolute safety which is assured in operating the switchboard or changing the fuses. By means of the glass covering, an inspector is enabled to note the condition of the pit at a glance, besides which the appearance of the equipment is much improved by the arrangement.

A large number of small d.c. motors of various sizes will be used in the manufacturing and repairing of jewelry and in the optical grinding department of the Birks establishment, and there will also be an ash hoist, dumb waiter and a ventilating system throughout, all electrically operated. The building will be cleaned by a portable vacuum process,

current being obtained from receptacles on the various floors. For the operation of a pneumatic cash tube system in the jewelry store there will be a three h.p. motor, and two small motore will be used for sump pumps in the sub-basement.

Altogether there will be 26 panels installed on the different floors. All corridors, toilets and janitor's quarters are controlled by two cabinets, one on the third and the other in the seventh floor, and each floor renting space has a cabinet which is controlled separately from the main switchboard in the basement.

The exterior illumination of the building consists of 120-100 watt tungsten lamps, placed between the medallions in the cornice. This is controlled by a separate cabinet on the ninth floor. Apart from the lighting in the upper por-



Rear of switchboard, buzzing and fuse rack.

tion of the building, there are 170 lighting circuits on the ground floor to provide interior illumination for the jewelry store. Frinck invisible reflectors are being used in the show cases. The lighting of the 200 feet of window space in the store is controlled by two time switches operated in such a manner that one-half of each window may be illuminated on dull days. All light and power, telephone and messenger service wires are run in sherardized metal conduit varying in size from one-half inch to four inches. This equipment was manufactured by the National Metal Moulding Company. Upwards of 60,000 feet of conduit and 175,-000 feet of wire have been used altogether.

Two ceiling outlets and two wall plugs are provided in each office, the majority of single offices having 150 square feet of floor space. Each office is controlled by an H. and H. switch placed in the entrance door casing at a height of four feet from the floor, and the wall receptacles are of Hubbell No. 5418. All offices facing on Georgia and Granville streets, from the first floor to the fifth floor, are specially equipped to suit doctors and dentists, having extra receptacles for dental engines and X-ray equipments. These offices were all rented en-suite before the building was completed and the contractors were required in most instances to install equipment suited to the individual wishes of each tenant.

All the duplex wire used in the building was supplied by the Standard Underground Cable Company, of Hamilton, Ont., and the larger sized wires were supplied by the Canadian General Electric Company.

The telephone system consists of a service of 330 pair, 30 pairs of which are used for a private exchange in Henry Birks & Sons store, and 300 pairs for the service in the remainder of the building, the latter being run in lead sheathed cable up a pipe shaft and splices made on the third and seventh floors where branch cables of 30 pair are connected to the main cable and run to each separate floor. This 30 pair is run to a strip box on each floor, and from there, No. 19 twisted pair is run in a wire moulding through the corridors and through a conduit bushing to the various offices. There is also a messenger system throughout which is run in conduits.

In connection with the elevator system special mention must be made of an automatic signal system to be installed in connection therewith, which will automatically give a signal to the elevator operators when it is time to leave the upper and lower limits of travel. This system is manufactured under patents issued by Mr. Roy Griswold, of Seattle, Wash., and operates as follows: When two cars only are running, either car reaching the top floor signals the other car at or nearing the bottom to start upward, which in turn signals the car at or nearing the top to start downward. When traffic demands the third car to begin running, the operator by closing a switch places the system in readiness for three cars, and starts his car in either direction of travel without notifying the other two operators. Any car travelling downward at a pre-determined point signals any car at or nearing the main floor to start upward. This car in its upward travel at a pre-determined point, signals either of the other cars, which is at or nearing top floor, to start downward. In the same manner the fourth car is put in operation by closing a switch. These switches are accessible to all operators; thus any car can be started or stopped without notifying the operators of other cars, as changing the switch causes signals to be given to suit condition of the number of cars running.

The firm of NePage, McKenny & Company, electrical engineers and contractors, Vancouver, is in charge of the electrical installation throughout the building. Mr. E. G. Mundy, the local manager, is personally supervising all work. This company is credited with being the largest electrical contracting concern on the Pacific coast, with branches at San Francisco, Portland, Spokane, Seattle, Vancouver and Victoria, and among the important contracts awarded recently being the L. C. Smith Building, Seattle, Wash., a forty-two storey structure; the Devonport Hotel in Spokane, costing one and a half million dollars, and the fifteen storey Weart Building in Vancouver.

Canada's Latent Water-powers

A Brief Report on the Results of Recent Investigation Work in the Prairie Provinces

By Mr. Leo. G. Denis

During the first part of the year a large amount of time was devoted to a report on the Waterworks of Canada. The information which had already been obtained by correspondence was supplemented and brought to date. In some instances, to accomplish this, it was necessary to visit several towns in Ontario and Quebec and obtain from them data which could not be obtained by correspondence. This report is now in the printer's hands and will be ready for distribution in a short time. It contains a summary description of the waterworks systems of Canada, all arranged for ready reference. A portion of the report is devoted to charts and tables emphasising points of special interest, such as increase in the number of water-supply systems, rates, sources of supply, consumption per capita and sewerage conditions.

Water-Powers of Western Canada

To obtain further information for the proposed report on Western water-powers, a trip was made to the northern portions of the provinces of Alberta and Saskatchewan, to investigate water-power possibilities. The principal rivers

travelled over were the Peace, Slave, Clearwater, Methy and Beaver.

I left Ottawa on June 16th and reached Edmonton on the 19th. I found that the Hudson's Bay Company's steamer was only due to leave Peace River Crossing for Hudson's Hope, my first objective point, on July 10th. From Edmonton, where railway travel was abandoned, until the Canadian Northern Railway was reached at Big River, I travelled a total distance of 2,100 miles, of which 1,000 were by river steamers, 850 by canoe, and 250 overland, where the mode of transportation varied from automobiling to footing it behind a team of oxen.

Peace River Canyon

I left Edmonton on June 25th, passing through Athabaska Landing, thence by steamer and stage to Grouard and Peace River Crossing, arriving at the Crossing on July 3rd. I left for Hudsons Hope on July 17th, arriving at the latter place on July 25th. As a very complete survey of the Peace River canon had been made during the previous summer by Mr. G. B. Milligan, it was not necessary to make the proposed survey, Mr. Milligan kindly supplying a plan of his survey. As no levels had been taken, however, the portage was traversed to the upper end of the canyon, aneroid readings were taken for difference of levels and the canyon was explored for a few miles at each end. The descent of the water in the canyon is fairly uniform, except near the head where there is a descent of 25 feet in a half mile. The total descent from head to foot is 225 feet in 18 miles.

Vermilion Fall and Rapid

Leaving Hudsons Hope by steamer on July 27th, Fort Vermilion was reached on August 1st. Here men were secured and on August 5th we started down the river for Fort Smith. Next day the Vermilion fall and rapid were measured. The descent in the rapids is 14 feet, while that in the chute is 12 feet, giving a total of 26 feet in a distance of 1¾ mile.

The Boyer or Little rapid was measured on the 9th, and we reached the mouth of the Peace river on the 11th and Smith Landing on the 13th. During the whole trip from Fort Vermilion we were much delayed by heavy head winds and, at times, had to "track" in spite of the fact that we were

At Smith Landing, I found that, to level the descents between that point and Fort Smith, it was necessary to run the rapids, as, from the Sixteen-mile portage road, the river is inaccessible, except in a very few places. I accordingly hired a local guide and started down the rapids. The channel followed for the greater portion of the distance lies between the numerous islands on the east side of the river and the descent is effected by short pitches, some of which have to be passed by portages. In passing the last pitch of the last rapid, I had the misfortune of having my boat upset, losing several instruments and some personal effects. The whole trip through these rapids, including the time spent in taking observations and levels, took almost two days, after which I returned from Fort Smith to Smith Landing by the portage road.

Rapids of Slave River

The following are the descents observed in each of the five rapids:

Cassette rapid	27 feet
Second rapid	37 feet
Mountain rapid	25 feet
Pelican rapid	10 feet
Drowned rapid	13 feet

The total descent in the 16 miles where these rapids occur, including the swift waters between them, is about 135 ft.

I left Smith Landing by the Hudson's Bay Company's steamer Grahame on August 20th and arrived at Fort Chipewyan on the 22nd. Men with provisions and a canoe, who had been sent from Athabaska Landing by my instructions, were waiting for me. Next day, we started by canoe up the Athabaska river, reaching Fort McMurray on September 1st. On the following day, we proceeded up the Clearwater river and reached Methy portage on the 9th. The Clearwater was metered at the Cascades rapid and the descent in the Cascade, Le Bon, Bigstone and Pine rapids and in the Whitemud fall were levelled.

Rapids of Clearwater River

The following is the descent observed in these different rapids:

Cascades rapid	16 feet
Le Bon rapid	31 feet
Big Stone rapid	6½ feet
Pine rapid	21 feet
Whitemud fall	41 feet

Beaver River

I sent men over to the other side of the Methy portage for a team of oxen to portage our canoe and provisions and, after unavoidable delay, we finally reached the Hudson's Bay Company's post on Methy lake on the 12th and proceeded down Methy lake and river. The rapids were levelled and the river was metered above the mouth of the Whitefish river. We then crossed Buffalo lake and reached Ile-a-la-Crosse post on September 21st. Here, after purchasing some provisions we started on our way up the Beaver river on the same day, reaching the Grand rapid on September 24th, where levels were taken and the flow of the river metered. We continued ascending the Beaver river and by way of Cowan river and lake reached Big river on September 28th. We had to wait until October 1st for a train to take us to Prince Albert, which was reached on the same day. From Prince Albert, I sent the canoemen back to Athabaska Landing and left for Ottawa, where I arrived on October 6th.

Water-powers of British Columbia

Good Progress Made in the Investigations—Work of a Difficult Nature—A Brief Review

By Mr. Arthur V. White

In presenting a review of the work appertaining to water powers done under my direction during the season of 1912, I desire to point out, first of all, that the main work in hand is the collection of information respecting the water-powers of British Columbia, with the object of enabling the Commission of Conservation to publish a report dealing with the water-power resources of Western Canada.

Complicated Situation

No other province of Canada is confronted with the problem of adjusting so complex a water situation as exists in British Columbia. In the early 'fifties,' water rights and privileges for mining operations began to be taken up, and, subsequently, other rights and privileges were granted for irrigation in connection with the development of large agricultural areas. All of these rights are now represented by upwards of 5,000 water records, issued under various terms and conditions. In addition, there are others, given later, for water-powers. The application for waters for all purposes are on the increase. The whole situation is a difficult one, and, until adjudication upon conflicting interests can be had, patience and consideration will be required on the part of the record-holders, and caution, wisdom and courage on the part of the administration. These problems are now being dealt with by the Provincial Government, and, in this connection, two men, experienced in irrigation and water matters in the United States, Dr. Samuel Fortier and Mr. H. W. Grunsky, were, during a part of 1912, engaged in

considering ways and means of satisfactorily adjusting some of these problems.

Provincial Co-operation

When I arrived in British Columbia I found that the plans outlined for 1912, contemplating as they did a measure of co-operation on the part of the province with the Commission of Conservation, required some modification. Hon. William R. Ross, Minister of the Department of Lands, said that he desired to extend to the Commission any assistance he could and suggested that I confer with Dr. Fortier and others. A conference was held, and as our plans did not conflict with their work, the Minister's co-operation was extended, the province advancing $3,450 to cover their portion of the co-operative work. In the United States, much water investigation work is carried on co-operatively between the Federal and State authorities. For example, during the fiscal year 1912, the Water Resources Branch of the United States Geological Survey received for such co-operative work, from the state authorities of California, $25,500; from Minnesota, $16,000; from New York and Oregon, each over $13,000; from Idaho, $12,500, and from Washington, $4,400; while a number of other states contributed lesser sums. All the contributing states thus gave a total of nearly $114,000, and this co-operation has proved of mutual benefit. During 1913, it is expected that a further special appropriation will be made by British Columbia, probably larger than that of 1912.

It might add a little to the clearness of what I am about to say, if I explain what authorities exercise jurisdiction over water-powers in British Columbia. First there is the Water-power Branch of the Department of the Interior, which has jurisdiction over the Railway Belt. In addition, the Department of Lands of British Columbia has a Water Branch which deals with irrigation, and also a separate Lands Department dealing with water-powers, which reports direct to the Minister.

Railway Belt Water-Powers

In the report of the third annual meeting of this Commission, it is stated that in initiating the water-power investigation in British Columbia it was decided to begin systematically to cover the territorial area of the province. The area south of the Railway Belt, together with the Railway Belt itself contains the bulk of the population of the province; it also comprises the water power possibilities of more immediate economic importance, and, consequently, the investigation was commenced in these districts. A large part of the Province south of the Railway Belt, in 1911, was examined by the engineers of the Commission.

Through the courtesy of the Water-power Branch of the Department of the Interior, the hydrographer of the Railway Belt, Mr. P. A. Carson, has, during 1912, carried forward an investigation in his territory, and the principal field data respecting the water-powers in this area have been assembled. I understand most of these data have been reduced to a form readily adaptable for inclusion in the proposed water-power report. We are indebted to Mr. Carson, and his engineers, Messrs. C. G. Cline, C. E. Richardson, E. M. Dann and H. S. Keys for their assistance and also to Mr. J. B. Challies, Superintendent of the Water-power Branch. The Kamloops hydrographic office has had a heavy task with its own irrigation and other work, and notwithstanding this, extra effort was made by its staff to further the early collection of water-power information that had been requested. They have secured hydrographic data, including measurements of stream flow, for some of the large rivers, such as the Fraser, the North Thompson, the South Thompson, the Columbia, and the Adams.

Columbia River Survey

The Department of Public Works, Canada, in 1912, commenced an instrumental survey of the Columbia river around the "Big Bend." Through the courtesy of the Department, and the district engineer directing the survey, Mr. F. W. Aylmer, it was arranged that the Commission of Conservation might attach a man to this survey party, that he might make water-power investigations of the tributaries of the Columbia, using the main survey party as a base for operations. Meantime, however, a new water-power organization had been effected in the Lands Branch at Victoria, and Mr. G. Gray Donald was placed in charge of water-power work. As he desired to make some surveys on the Columbia, it was left for him to avail himself of any co-operation with Mr. Aylmer's party that might seem desirable. Mr. Gray Donald also commenced instrumental surveys of the Pend'Oreille and Kootenay rivers and the results will, later, be available for our report upon the water-powers of Western Canada.

Forests Branch Co-operation

The Forests Branch of British Columbia has just organized an extensive, systematic survey of the forests of the Province, and the chief forester, Mr. H. R. McMillan, has arranged to have the skilled men engaged upon this special survey, report specifically upon water-powers observed, if, after trial, such work is found not to hinder the progress of his own surveys. Mr. H. K. Robinson, who is initiating this forest survey work in the field, informed me that his assistants seemed much interested in the water situation, and were ready to co-operate in supplementing their forest reports with data relating to water-powers.

Co-operation of Surveyor-General

The Surveyor-General of the province, Mr. G. H. Dawson, has instructed British Columbia land surveyors who are executing the provincial land surveys, to send in information relating to water-powers. It is to be supplied upon special forms which, however, are not returnable to the Surveyor-General until later in the year, when the surveyors are handing in their survey reports. We are also indebted to the chief geographer, Mr. G. G. Aitken, who has very kindly assisted us with blue prints, and with advance copies of the new map of British Columbia.

Co-operation of Waters Branch

In the Waters Branch, B.C., through the courtesy of the Acting Chief Comptroller, Mr. J. F. Armstrong, there is now being compiled a complete, brief tabular synopsis of all the records and water reservations issued in the Province. These water records, as above intimated, constitute really the underlying basis of the water situation and, in many cases, they conflict with the possible development of power on streams to which they appertain. This tabulation will be available for our proposed report, and will constitute a valuable basic record.

Electric Inspection Branch Co-operation

The Electric Energy Inspection Branch of the Department of the Attorney General of British Columbia, under the superintendence of Mr. D. P. Roberts is co-operating to secure some desirable information relating to the hydro-electric power companies now operating in the province.

Survey of North Thompson

During 1912, a firm of engineers were conducting a railway survey and taking levels down the North Thompson. It was not possible to send a party into this territory, but through the kindness of one of the members of the firm, data was obtained respecting tributaries of the North Thompson. This work was done for a nominal sum.

Data from United States Surveys

In January, 1913, while in Washington, D.C., at the conference of District Engineers engaged upon stream gauging in the United States, I met the engineers who are conducting water-power investigations in Idaho, Montana and Washington. A considerable body of data will later be available from the investigations of these engineers; especially as a

result of the work of 1913. The state of Washington, for example, will investigate the rivers in the portion of the State adjoining British Columbia and the results will be available for our report. They will be valuable since they are derived from territory corresponding in physical characteristics to portions of British Columbia.

Field Operations in 1912

Our own field work in 1912 was commenced in early July in the Cariboo district. Engineers G. H. Ferguson, A. W. Campbell, C. J. Vick, L. G. Mills, and F. Burd outfitted with pack horses and supplies at Quesnel. Mr. Ferguson's previous experience facilitated the securing of horses—an expensive factor of survey cost—at a reasonable rate. Messrs. Campbell and Vick were each in charge of a sub-station of the work, while Messrs. Mills and Burd acted in the capacity of assistants. A very considerable amount of territory embracing the tributaries of the Fraser river to as far north as the Grand Trunk Pacific Railway, was covered. The major portion of the responsibility for this work was upon Mr. Ferguson, and his application contributed much to its success. Representative photographs were secured, those taken by Mr. Vick being especially good. In all about 3,300 miles were travelled by the Cariboo party.

Mainland Coast Survey

Two parties, each consisting of two men, were despatched up the mainland coast, beginning just north of Powell river. They were instructed to examine all streams entering the various inlets. A 40-foot gasoline launch, the "Lizette," was chartered, and outfitted for three months. I regret, however, that the measure of success attained by the West Coast party was not what I anticipated. While work on this coast is especially difficult, and the heavy rains make it necessary to operate under disagreeable and trying conditions, there is often, in such investigations, a temptation to hurry over the ground, although explicit instructions have been given that the work must be done in a thorough manner. Too much time was spent on the smaller streams and the larger ones were not followed far enough up from their mouths, and I now doubt the advisability of sending more than one party in one boat. The basic idea in planning the work was that one party would go up one stream, the other party up another, and the engineer would manoeuvre the launch to pick the men up with the least possible loss of time on their return. This interdependence of one party upon another may have had an undesirable influence upon the party that should have gone up their streams farther; and it may sometimes have been difficult to apportion the time to the respective parties. It is estimated that the coast party covered about 3,000 miles, much of which distance was necessitated by the trips in and out of the long inlets. However, considerable data was secured and the deficient information can probably be obtained by a couple of men using the steamers plying along the coast.

The season, during which it is profitable to carry on reconnaissance water-power investigations in British Columbia is comparatively short, and it is almost impossible for observers to avoid over-estimating the power possibilities of streams observed during high stages.

Assemblage of Data Requires Time

After drawing attention to these matters connected with work performed in British Columbia, and to the efforts being put forth by the various co-operating agencies named, it may erroneously be inferred that much more data is in hand than is actually the case. I have endeavored to outline the avenues along which efforts have been, and are being, directed in order to secure information, and to indicate the measure of success that has attended these efforts. The majority of persons from whom cognate information must come are pressed with their own matters, and it has been necessary for me to do a certain amount of personal co-operative work in order to secure their co-operation, and to manifest the desire of the Commission of Conservation to assume its own share of the labor of securing information. All these matters take time and the information may be, and often is, delayed. It must be appreciated, therefore, that much of the data above referred to is not yet in hand, but it is gradually coming in.

Suggested Surveys on Vancouver Island

I had hoped to examine some water-powers on Vancouver Island on which there are some important power streams, notably Campbell river, but funds did not permit. I have always felt that a territory so well confined, and relatively of such limited extent as the Island, should not be subjected to the class of reconnaissance investigation that would be justified for larger areas. In the United States, there is an increasing tendency to do preliminary work of investigation of power rivers in a more detailed manner; the streams are profiled, and possible dam sites, and storage reservoirs, are contoured. This results—without undue increased cost—in the production of permanent survey records of enhanced value. I think that Vancouver Island presents an excellent opportunity to make an investigation of its rivers in a manner to yield data of a higher standard, and thus leave the work more complete, and an example of what may next be striven for in other parts of the country. I propose to discuss with the Minister of Lands for British Columbia, the possibility of conducting such a water-power survey on the Island, and to undertake at least a portion of this work along the lines just suggested.

In the northern portion of the state of Washington much greater outlay is now being made for water-power investigation and surveys, and it is especially desirable to make corresponding investigations in this country, especially upon waters which flow across the boundary. It is understood, of course, that good judgment is called for in the selecting of where, and in determining to what extent, such work should be performed.

Other Work

During the year I assisted in the preparation of the Chicago Drainage Canal report, and, prepared a report dealing with the Long Sault power project. In August, I returned to Ottawa, and spent September assisting upon work connected with the references before the International Joint Commission relating to a proposed regulation of the level of the Lake of the Woods. In this connection, I attended public hearings at International Falls and Warroad, Minnesota, and at Kenora, Ontario.

Plans for Work, 1913

In 1913, it is proposed to deal with the territory tributary to the Grand Trunk Pacific, and the Pacific and Great Eastern railways, along with the balance of the west coast, Vancouver Island, and probably part of the country lying well to the northward of the Grand Trunk Pacific Railway.

In 1912, due to the demands of travel, the work was necessarily more expensive than in 1911. Owing to increased freight rates and lack of competition, the prices for food and other supplies increase the farther inland one goes. Take, for example, the parties operating last year in the Cariboo district. The average cost of food per man per day for the Quesnel River investigation was 80 cents; for the Blackwater River district, $1.00; and for Willow and Bear rivers, $1.20. A fair average for food for this work would be $1.00 per man per day. Saddle horses ranged from $1.25 to $1.50 per day, and pack horses from $1.00 to $1.25 per day. For the most part, the horses grazed for themselves. Hay ranges in cost from $50 per ton upwards, and, in the Chilcotin district, oats cost from $1.00 to $1.35 per bushel. In 1913, I expect the field operations may be considerably more costly than in 1912.

New Plant of Dryden Timber and Power Co.

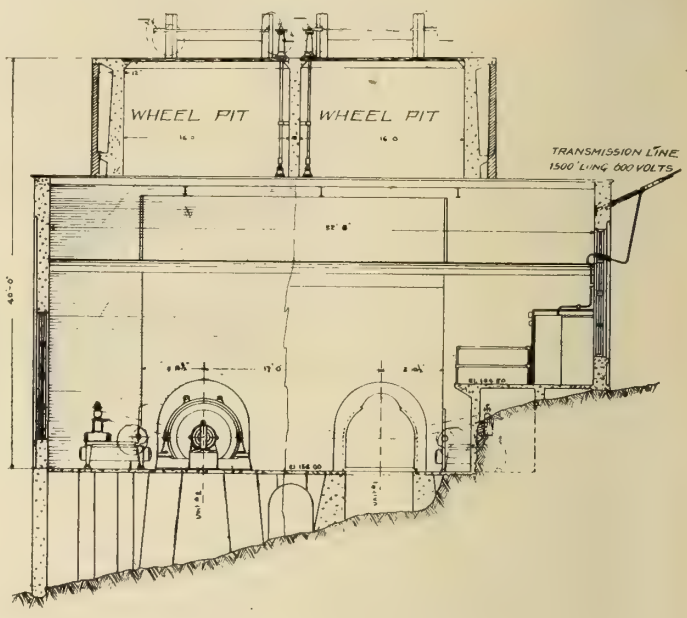
An Installation Possessing Several Unique Features in Design and Construction—Turbine Capacity of 2000 H. P.

A hydro-electric development of 2,000 horse power capacity has just recently been completed for the Dryden Timber & Power Company at Dryden, Ont. The power will be used for operating sulphite pulp mills of this company and for supplying light and power to the town. The plant is situated on the Wabigoon River at a point about one mile below Lake Wabigoon, and just opposite the town of Dryden, which is half way between Port Arthur and Winnipeg on the main line of the Canadian Pacific Railway.

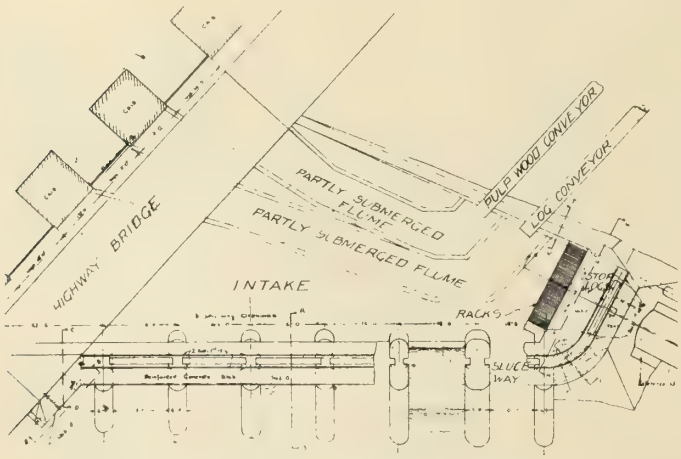
Lake Wabigoon has an area of some 60 square miles and constitutes a very desirable reservoir for this power development. The water shed area feeding this lake is in the neighborhood of 800 square miles. The river flow is about 400 c.f.s. The development is the result of utilizing three distinct falls which, in a distance of 1,600 feet have a total drop of about fifty feet.

The dam is of concrete, 120 feet long by approximately 25 feet high. It consists of a series of piers placed 16 foot centres with concrete spillways and stop logs between and with reinforced concrete slabs across the top, over which the winches operate on a built-in track. The dam is built at an angle across the river, providing ample spillway area to take care of surplus water in time of flood. A sluiceway is provided which can be opened to the full depth of the dam in case of extraordinary flood. The small forebay formed by the dam, diminishing in width towards the mouth of the pipe, serves also as an approach for the saw logs and pulp logs to the mill.

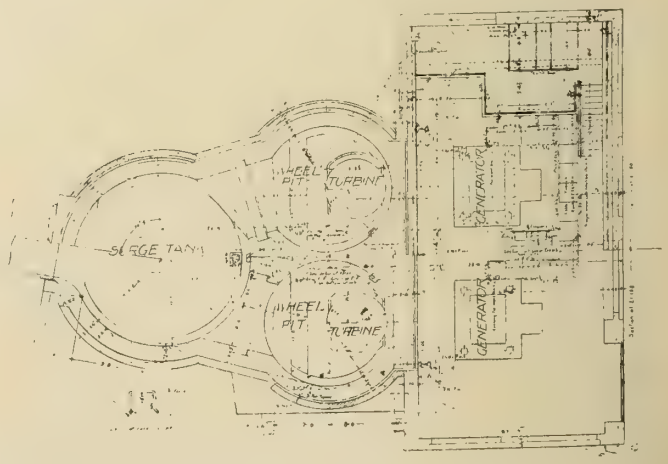
Just above this forebay the river widens out into a small lake which is part of Lake Wabigoon, and the entire season's cut of logs both for pulp and for lumber and ties is assembled here in booms. Across the entrance to the forebay is a series of cribs to which are attached the various booms by which the logs are controlled. Two partly submerged flumes, one for pulp logs and one for saw logs and ties, lead from this line of cribs, through the forebay, to chain conveyors situated near the entrance to the pipe, which lift the logs from the water and carry them to the mill. These flumes serve to guide the logs, and to keep bark and sticks or small pulp logs from approaching the racks. A steel thimble set in the concrete connects the dam with a wood stave pipe 1,500 feet long and 9 feet inside diameter. Stop logs and racks are, of course, placed in front of the pipe mouth. The pipe line is constructed of 4-in. x 8-in. B. C. fir, bevelled to shape. The bands are of 3/4-in. steel, spaced 9-in. apart. The pipe line is supported on wooden blocks spaced about 10 feet apart and for a distance of 200 or 300 feet rests on a wooden trestle at a height of 12 or 15 feet. In passing under the C. P. R. embankment a reinforced concrete pipe is substituted for the wood stave. The wall of the concrete pier is 12-in. thick, treated both inside and out with a waterproofing compound and a coating of asphalt. The pipe is laid on a grade of 0.266 per cent. sloping towards the power house. The design of the power house is shown in the accompanying figures in both plan and cross sections. An important feature is the surge tank and the two open wheel pits designed to secure good regulation. The tank and the wheel pits are built of reinforced concrete and are circular in shape, the surge tank being 22 feet diameter, and the wheel pits 16 feet each, grouped as shown in the drawing. Owing to the circular form of the tanks, there is no bending moment in the walls, and the stresses due to the head of water are taken up by



Section of power house through generators.



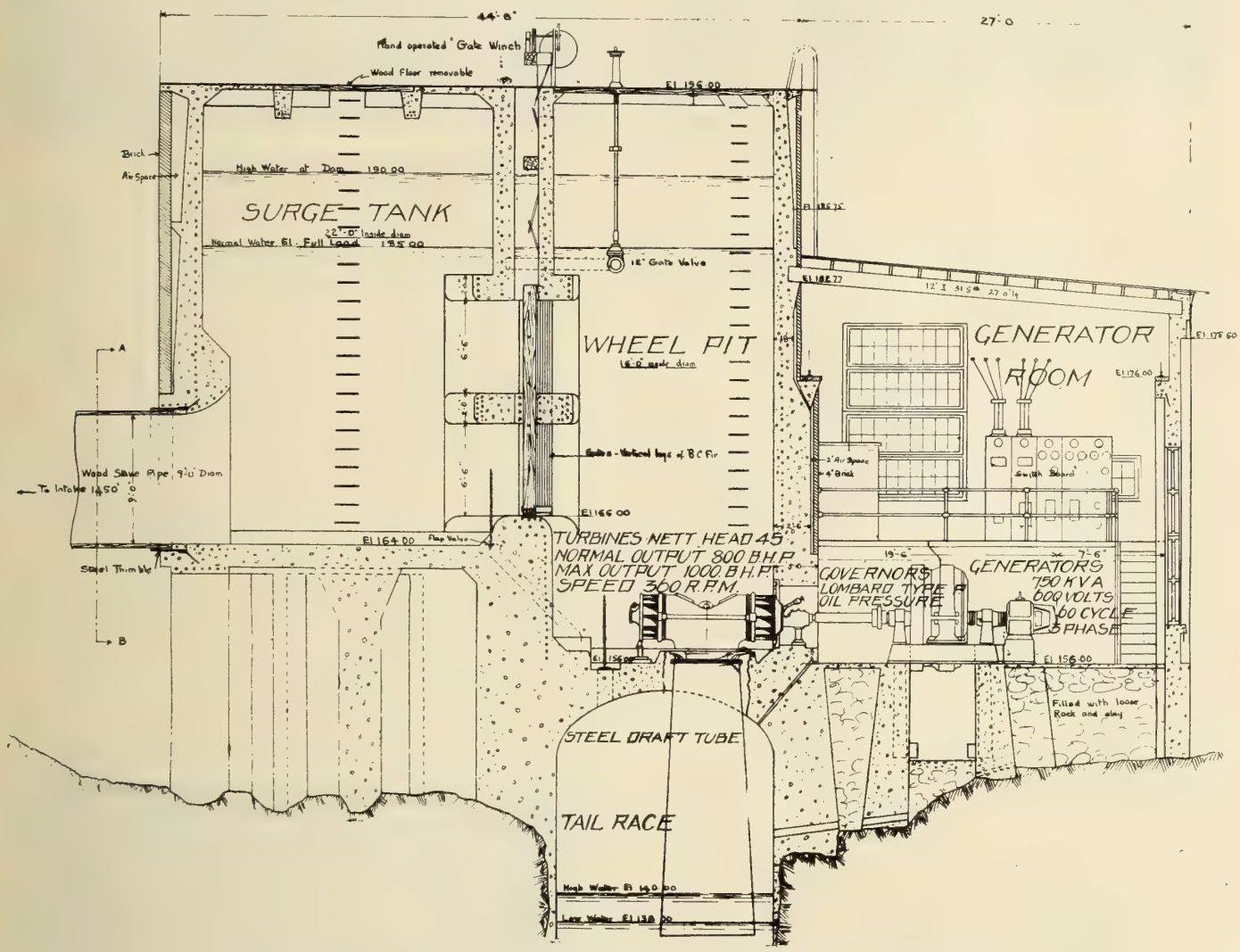
Dam, sluice-way, intake, submerged conveyors, etc.



Showing general plan of Dryden power plant.

direct tension in the reinforcing steel, the concrete serving merely as an envelope to contain the water. This form of construction takes considerably less concrete and reinforcing steel than would be required in rectangular tanks. The walls of the tanks are 24-in. thick at the bottom and 12-in. at the top and 40 ft. in height. The velocity of the water entering the wheel pits is about 2 feet per second. The wheel pits may be isolated from the surge tank by the lowering of wooden gates composed of vertical timbers operated by hand winches.

The turbines are placed on the floor of the wheel pits which is about 18 feet above extreme low water and the



Cross section showing surge tank, wheel-pit, turbine, generator, draft tube, etc.

water is carried off by two steel draft tubes which empty into the same tail race above which the wheel pits are supported on a concrete arch.

The turbines, of which there are two, are of the Francis twin central discharge open flume type, each designed for a working head of 45 feet and capable of developing 800 B.h.p. with a water supply of about 190 c.f.s. at 360 r.p.m. The turbines have a maximum capacity output of 1,000 B.h.p. Each unit is provided with two runners constructed with buckets of heavy flanged mild steel plates cast into a centre boss and surrounding ring of cast iron. Each runner is mounted inside a cast iron guide casing provided with a set of cast iron adjustable guide plates fitted on steel spindles. of cast iron adjustable guide plates fitted on steel spindles. The turbines are mounted on a cast iron sectional type central discharge casing provided with two large manholes fitted with covers for giving access to the runners and fitted with heavy cast iron foundation plate for setting in floor of turbine pit. Each turbine is fitted with a rivetted steel tapered suction tube 16 feet long with flange on the upper end for connection to the foundation plate and bell-mouthed at the lower end.

The governors are of the Lombard oil pressure quick acting returning relay type, complete with pressure and exhaust tank relay valve, main controlled cylinder, etc. They are fitted with high speed sensitive governor heads with suitable balanced piston valves for operating the relay valves and are of ample power to operate the regulating guide blades in the turbines. The governors are capable of controlling the speed within the following limits:—

Ordinary gradual load changes—speed variation not to exceed 1½ per cent.

Twenty-five per cent. sudden change of load—speed variation not to exceed 3 per cent.

Fifty per cent. sudden change of load—speed variation not to exceed 6 per cent.

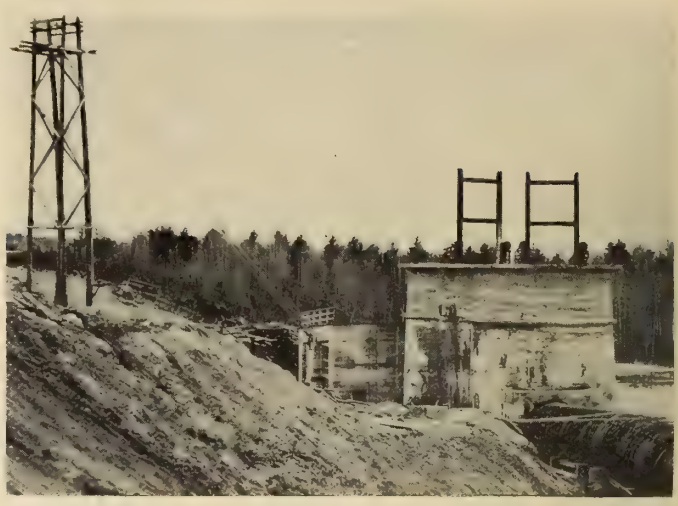
One hundred per cent. sudden change of load—speed variation not to exceed 16 per cent.

The fly wheel effect of each generator is 1,000 ft. tons at 360 r.p.m.

Two sets of independent triple oil pumps are provided for operating the governors, each arranged for belt driving from the turbine shaft and each set of sufficient capacity



Dryden power house—discharge side.



Intake side, also showing 4-pole tower.

for the proper operation of the two governors, if required.

The turbines are guaranteed to develop not less than a maximum of 1,000 B.h.p. each under an actual working head of 45 feet at 360 r.p.m., the efficiency of the turbines to be as follows: full load 81 per cent., 7/8 load, 85 per cent., 3/4 load 83 per cent., half load 75 per cent.

The generators are 3-phase, 60 cycles, 600 volts, 360 r.p.m., 750 kv.a. each, of the revolving field water wheel type. They are constructed on cast iron bed plates with two main pedestal bearings provided with ring lubricated bearings. Each generator is guaranteed to develop its rated output continuously with a temperature rise not exceeding 40 degrees C. and of developing 25 per cent. overload continuously with a temperature rise not exceeding 50 degrees C. and of developing 50 per cent. overload momentarily without danger. Each generator is provided with a direct-coupled exciter mounted on an extension of the main base plate, each exciter being large enough to feed both generators at full load. The efficiency at unity power factor is guaranteed as follows: ¼ load, 83.4 per cent.; half load, 90.5 per cent.; 3/4 load, 92.7 per cent.; full load, 93.5 per cent.; 1¼ load, 93.8 per cent. The regulation at unity power factor is 8 per cent. and at 80 per cent. power factor is 16 per cent.

The switchboard consists of five panels of black enamel slate mounted on an iron frame work. The two generator panels are each fitted with three ammeters; one triple pole oil break switch fitted with two maximum over load trip coils; one set of synchronous plugs; one set of volt meter plugs; one integrating watt meter; one double pole field switch and one alternator field regulator. The exciter panel is fitted with a volt meter; two sets of volt meter plugs; two double pole exciter switches; two field rheostats; one lighting switch; two ammeters. The two feeder panels each carry one ammeter and one triple pole oil break switch fitted with two maximum over load trip coils and one no-volt trip coil. A swinging bracket fitted on the end of the switchboard carries a rotary type syncroscope, a busbar volt meter, an incoming machine volt meter and a frequency meter. The board also carries a recording watt meter of the unbalanced load type.

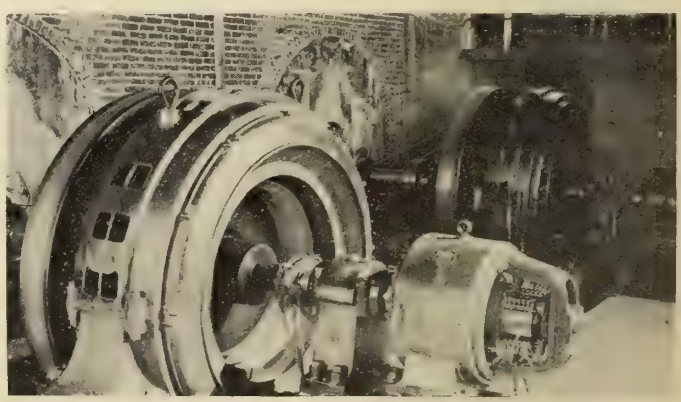
On account of the comparatively short distance between the pulp mill and the power house, it was not advisable to step up the voltage and energy is therefore transmitted at the generated voltage of 600. On this account very large cables are used. These are of aluminium, 960,000 circular mils in cross section. There is a double 3-phase circuit carried on a two-pole line. At certain points where terminal towers are required, these are of the four-pole type. Poles are spaced approximately 90 feet apart.

The sub-station equipment consists of a distributing board of enamel slate fitted with 800 ampere, 3-pole, slow break knife switches for controlling the lines from the power house. From this switchboard four circuits are distributed, each fitted with one ammeter and a 3-pole slow break knife switch. Choke coils and lightning arresters are also supplied at this point for each of the six lines.

The distributing cables run on porcelain insulators, a distributing box being provided at every junction, these containing switch fuses, one set for each motor. These fuses set very high, being chiefly intended for protection against line troubles, each motor starter being provided with no-volt overload features to care for ordinary overloads.

The motors used to operate the various equipment throughout the mill vary in size from 7 to 250 h.p., 31 motors in all being installed. The various motors with the uses to which they are put are as follows:

One 7 h.p. for conveyor; four 7 h.p. for pumps; two 8 h.p., conveyors; three 10 h.p., recovery pumps; one 13 h.p., chip conveyor; one 20 h.p. boiler feed pump; five 25 h.p.,



Two 750 kv.a. generators, with exciters.

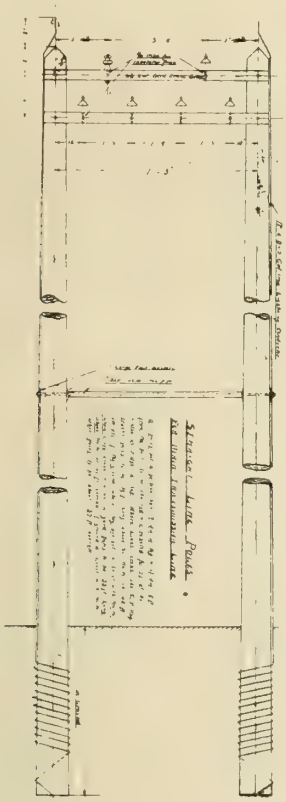
barkers; one 25 h.p., liquor pumps; one 50 h.p., main water pump; one 50 h.p., induced draft fan; one 50 h.p., pulp wood conveyor; one 75 h.p., line shaft; one 90 h.p., screen room; two 90 h.p., recovery room; one 90 h.p., slasher; one 90 h.p., hog; one 180 h.p., beater room; one 150 h.p., conveyor and pump; one 250 h.p., saw mill.

Of these motors the two largest are the wound rotor type but all the others are squirrel-cage motors.

The various pumps with their sizes and the uses to

which they are being put are:—one 1,000 gal. unit for pumping caustic liquor; one 1,400 gal. unit for main water pumping operating at a 105 ft. head; three 450 gal. 33 foot head, caustic liquor pumps; four 375 gal. 25 foot head, pumps specially installed for operating the digesters under 125 lbs. pressure, and one 1,000 gal. boiler feed pump working under a 370 foot head. All the above pumps are centrifugal type and direct-connected to the motors. The main water and boiler feed units are medium and high lift turbine types respectively.

The dam, pipe line and power house were planned and constructed under the supervision of the engineering firm of Harris & Harris, Confederation Life Building, Toronto. Mr.



Design of two-pole tower.

A. L. Cavanagh was resident engineer on the work. The turbines were manufactured by Jas. Gordon & Company, of London, Eng.; the stop-log and gate winches were supplied by the Wm. Hamilton Company, Peterboro. The structural steel racks, etc., were furnished by the Jenckes Machine Company, Sherbrooke; steel pipe bands, by the Steel Company of Canada; governors are of the Lombard type; generators were manufactured by the Lancashire Dynamo & Motor Company, Manchester, as were also the motors. The switchboard is of Ferranti manufacture. The pumps were supplied by W. H. Allan, Son & Company. The supply and installation of the turbines, governors, generators, motors, pumps, switchboards and transmission line were in charge of the engineering contracting firm of Chapman & Walker, Toronto.

Personal

Mr. Chas. F. Barnes has been appointed acting manager of the London Electric Company, succeeding Mr. E. I. Jenking.

Mr. Warren Y. Soper, vice-president of the Ottawa Light Heat & Power Company, is enjoying a motor trip through Maine this month.

Mr. Thomas Ahearn, President of the Ottawa Electric Railway Company, and Mr. James D. Fraser, secretary-treasurer, returned last week from a two months' motor tour of the United Kingdom. Mr. Ahearn took over his own car and chauffer and the 1,600 mile trip was made without any mishap or accident whatever, nor even a puncture. They also visited the International Exposition in Ghent.

Trade Publications

Steam Traps—Bulletin issued by Canadian Allis-Chalmers, Limited, descriptive of the "Squires" improved steam traps.

Weatherproof Sockets:—Form 629, issued by the H. W. Johns-Manville Company, describing J. M. moulded weatherproof lamp sockets.

Dossert Connectors—The Canadian General Electric Company are distributing a small pamphlet descriptive of Dossert Connectors, for which this company are selling agents.

Electric Flashers—Bulletin No. 27, issued by the Reynolds Electric Flasher Manufacturing Company, descriptive of Reco flashers, comprising single pole, double pole, on and off, two or three color, spelling, speed, script, chaser, lightning, flag and cabinet types.

Electric Grinders—Bulletin E29, issued by the Chicago Pneumatic Tool Company, descriptive of Duntley Electric Grinders of various types. Also bulletin 34B issued by the same company descriptive of pneumatic power driven compressors.

Arc Welding—Catalogue 3002 issued by the industrial and power department of the Westinghouse Electric & Manufacturing Company. This catalogue is more or less historical, describing the various methods of electric arc welding with special reference to the latest and most approved process.

Car Equipment—The Electric Service Supplies Company have just issued their supplement to catalogue No. 4, volume 2, which deals with car equipment and supplies. The supplement is splendidly bound in cloth, and comprises some 170 pages of well printed and illustrated matter with reference to their new and improved devices.

Steel Gear Cases—The Electric Service Supplies Company have recently issued a folder illustrating and describing the different processes of manufacture of their Keystone Steel Gear Cases. Illustrations clearly indicate the method of spot-welding embodied in the manufacture of these cases, as well as their repairability and lightness.

Westinghouse—Leaflet 3572, describing, with ilustrations, the New York, New Haven and Hartford, 11,000 volt, single-phase, alternating current railroad electrification; leaflet 3517, describing Westinghouse portable sub-stations; leaflet 3685, describing direct current, commutating pole, type S. K. generators, 1½ to 200 kw. capacity and 125 to 250 volts.

Charging Rheostats—The Cutler-Hammer Manufacturing Company, Milwaukee, have just published a new edition of Bulletin No. 8540, dated August, 1913, which supersedes their former bulletin of the same number, but of an earlier date. The new bulletin contains prices and data on their various types of charging rheostats for both lead and Edison batteries, including wall, floor and switchboard types, besides two styles of automatic rheostats.

Sand Drier—"The Electric Service Supplies Company have issued a folder describing, illustrating and listing their new improved Keystone Sand Drier. The new features embodied in this sand drier overcome many of the difficulties railway, mining and construction companies have met with in solving the problems of drying sand.

Copper vs. Aluminium Cables in Mines

Insulated and Bare Copper and Aluminium Cables for the Transmission of Electrical Energy, with Special Reference to Mining Work

By Burkewood Welbourn, M. Inst. E. E.*

While copper is a well understood and consistently reliable metal, and standard cables, fittings, etc., have been worked out for it, and the disposition undoubtedly is to leave well alone, there is no inherent electrical reason why insulated aluminium conductors should not be used for all purposes and at all working pressures. The writer believes that there will be little disagreement with his own conclusion as regards the use of copper or aluminium, namely, that every case should be settled on its merits. Usually, this will resolve itself into a question of a strict comparison of the cost of the rival systems. The matter is worth close investigation as the transmission of the current may account for 50 per cent. of the cost of the electrical equipment of a mine.

The world's annual production of copper is about 1,004,485 tons, and of aluminium approximately 60,000 tons. There is some uncertainty as to the figures of production for the United States, as they are kept secret. From the foregoing statistics, however, it may be deduced that aluminium has not, up till now, made any serious impression on the use of copper for electrical work. It is thought that only about 15 per cent., or say 10,000 tons, of all the aluminium produced is so used, and it will be seen later that this is only equivalent to 20,000 tons of copper. It is known that further plants are now being constructed which will increase by 50 per cent. the present output of aluminium within the next two or three years; and, as improvements in manufacturing methods are likely to reduce the cost of production, a reduction in the selling price should follow, and result in a considerable increase in its use for electrical work, unless a corresponding reduction is made in the price of copper.

Properties of Copper and Aluminium Compared

(a) **Chemical.**—Electrolytic copper-wire bars contain about 0.2 per cent. of impurities, and should comply with the requirements of the Engineering Standards Committee of March, 1910; but there is no E.S. Committee's standard for aluminium. Aluminium bars usually contain 0.5 to 0.7 per cent. of impurities (chiefly silicon and iron), and these should never exceed 0.71 per cent., at which figure the conductivity of hard-drawn aluminium is 60 per cent. when compared with the British standard for hard-drawn copper at 60 deg. Fahr.; with 0.5 per cent. of impurities the conductivity will be as high as 61.7 per cent. If the impurities do not exceed 0.75 per cent., as can invariably be arranged, then the writer is of opinion that bare aluminium wires can be used in the United Kingdom in any situation in which copper wires can be employed. This opinion has been arrived at after careful inquiry in various quarters, and after tests made by Dr. T. T. Best and the writer at Hardshaw Brook Chemical Works, St. Helens, Lancashire.

It has frequently been stated that aluminium is quite unsuitable for use on overhead lines on the coast, because of the salt spray. This, no doubt, is true if aluminium alloy is used; but if aluminium of the purity previously mentioned is employed, no more corrosion will take place than with copper, as is shown by the present condition of the aluminium cable, which has been in use on an overhead line at Larne Harbour, County Antrim, for about 10 years. Aluminium will not withstand hydrochloric acid or alkaline solutions, but it is extremely unlikely that such chemicals would be found in any situation in which an overhead line (copper or aluminium) should be used. For lines near coke-ovens, aluminium should always be used, as it resists the action of sulphur dioxide products, whereas copper will no do so. It is well known that when copper cables are insulated with vulcanized bitumen or rubber, the outside layer of the wires must be tinned to prevent the action on the wires of the suphur employed in the vulcanizing process. When aluminium is substituted for copper, no such precaution is needed, as it is not acted on by sulphur.

(b) **Electrical.**—In Table I. the electrical conductivity of copper and aluminium is compared:—

Table I.—Comparison of Electrical Conductivity of Copper and Aluminium

	Copper	Aluminium
Conductivity for equal section	1.00	0.60
Section for equal conductivity	1.00	1.666
Diameter for equal conductivity	1.00	1.29
Weight for equal conductivity	2.00	1.00
Weight for equal bulk	3.30	1.00

If equal sections of copper and aluminium are tested under equal conditions, it will be found that an aluminium conductor will carry 60 per cent. of the current that a copper conductor will carry with the same loss of energy. Conversely, the cross-section of an aluminium conductor must be 1.666 times that of a copper conductor if it is to carry the same current with equal drop of pressure. To make this clear, the following example will be taken:—

A copper conductor of 0.10 square inch area will carry 100 amperes, when worked at the standard density of 1,000 amperes per square inch. An aluminium conductor of 0.10 square inch area will only carry 60 amperes. From this it follows that an aluminium conductor for 100 amperes must have a cross-sectional area of 0.1666 square inch. By an extension of the previous example, it will be found that, for a given current, the aluminium conductor required has a diameter which is 29 per cent. greater than the copper conductor. Because of that larger diameter, insulated aluminium cables have an electrostatic capacity about 14 per cent. greater than that of the equivalent copper cables, and this may prove advantageous where alternating current systems are working at a low power factor. A noticeable feature in the comparison is that, for a given current-carrying capacity, theoretically only half the weight of aluminium is required as compared with copper, and in practice this is also nearly true. This lightness is of considerable importance, especially when bare conductors have to be transported across country for overhead-line construction.

(c) **Physical.**—The co-efficient of linear expansion per degree Fahrenheit is 40 per cent. greater for aluminium than for copper. So far as the author is aware, this has not been a source of difficulty, but it is evident that provision should be made for the expansion of insulated aluminium conductors, if they are to be worked up to their full current-carrying capacity, as, with insulated cables, heat is not rapidly dissipated. With uncovered aluminium cables, however, the dissipation of heat is more rapid than with copper cables, as on account of their greater diameter the radiating surface is greater. The difference is sometimes as much as 10 per cent.

(d) **Mechanical.**—Annealed metals are employed for the conductors of insulated cables, and are not used under ten-

* Extracted from paper read before the I.M.E.

sile stress, so that their tensile strength is of no importance; the strength is, however, all important for overhead lines, and hard-drawn conductors must always be used for them. The strength of hard-drawn copper and aluminium varies widely, and depends on whether the material is hot-rolled or cold-rolled. Hot-rolled copper gives sufficiently good results for all purposes which are being considered, but aluminium for overhead lines should always be cold-rolled, despite the greater expense. Cold rolling, coupled with improved manufacturing processes in England, has increased the breaking-strain of aluminium by 10 per cent. over that obtained only three years ago. As this result has considerable bearing on the design of overhead lines, it is suggested that individual wires for such lines should be specified to comply, after stranding, with the tests given in Table II., without interfering with the electrical conductivity already mentioned:—

Table II

Standard Wire Gauge.	Diameter of Wire	Breaking-strain.	Extension on a 5-inch Length.	Wrapping Test.
	Inches.	Tons per square inch.	Per cent	
4	0·232	11·00	3·00	Three times round its own diameter on and three times off.
6	0·192	12·00	3·00	
8	0·160	13·00	3·00	
10	0·128	13·50	3·00	
12	0·104	14·00	2·50	
14	0·080	14·50	2·50	
16	0·064	14·75	2·50	

The object of the wrapping tests is to ensure that no brittle wire is used.

It will be noticed that no suggestion is made in Table II. as to what the limit of elasticity (yield-point) should be. For aluminium it is usually assumed to be 70 per cent. of the ultimate breaking-strain, and, for copper, 75 per cent. In the case of aluminium, the yield-point is not readily ascertained by an inspection of a stress-strain curve, but Messrs. Burstall and Monkhouse, from the results of their investigations, take the yield-point at the stress where the permanent set is a hundredth of an inch on a 5-inch test-piece.

The breaking stress was 12.45 tons per square inch; the yield-point 9.54 tons per square inch, equal to 76.5 per cent. of the breaking-stress; and the extension on the 5-inch test-piece was 3 per cent.

It should not be inferred that the limit of improvement in manufacture has been reached, as recent independent tests on single wires from a 19/0.183 stranded conductor gave the following results:—

Breaking-strain ... ...15.38 tons per square inch.
Yield-point ... ...10.07 tons per square inch.
Extension ... ...3 per cent.

On a large number of wires of a diameter of 0.201, 0.142, and 0.135 inch respectively, the average breaking-load was 14 tons per square inch, the limit of elasticity 10 tons per square inch, and the extension 4½ per cent. after stranding.

The Transmission of Electrical Energy

For transmitting electrical energy for mines, both copper and aluminium may be employed.

(a) As insulated conductors in the form of cable for use below ground.

(b) As bare or braided conductors suspended on insulators on an overhead line on the surface.

It will be convenient to discuss (a) under the general heading of "Insulated Cables," and (b) under "Overhead Lines."

(a) **Insulated Cables.**—Up to the present time copper conductors for insulated cables have had almost a monopoly in this country, both for high and low-pressure work, and there appears to be no case in the United Kingdom in which aluminium cables have been used for shaft or in-bye work in a mine. In mines, except for electric-lighting distribution circuits, cables are almost invariably insulated with impregnated paper, or bitumen, and they are usually protected with wire armour and compounded tapes or jute. The armour is used for,—

(1) Mechanical protection and for relieving the strain on a cable when suspended or when a "fall" occurs.

(2) Providing an earthed conductor to surround the cable for the prevention of shock in the event of a fault, by carrying any leakage current directly back to the controlling switchboard, and ensuring the immediate cutting off of supply from the faulty cable or apparatus.

(3) Assisting in preventing open sparking. In the case of paper-insulated cables, a lead sheath is frequently employed below the armour to keep the paper dry, and it, also, materially assists in the prevention of open sparking, and is therefore to be preferred to a bitumen sheath.

Some stress is laid on the use of armour, because the diameter of aluminium cables is greater than that of the equivalent copper cables, hence the cost of protecting an aluminium cable exceeds that of a copper cable. Compounded tapes or jute string are used to protect the armour, etc., from corrosion, and should be impregnated in vacuo with a flexible waterproof compound before application to the cable. Investigation of cables protected with jute string shows that the jute opens at bends in the cable and allows the water of the mine, often corrosive, to have access to the armour. The writer is of opinion that compounded hessian tapes afford much more certain protection than jute string. Too much stress need not be laid on the corrosive action of water, provided that the best modern armoured and taped cables are employed; but, undoubtedly, fair samples of the mine waters should always be analysed by an experienced chemist before a final decision is taken as to the cable to be installed. The chief corrosive agents to be guarded against in vulcanized-bitumen cables are (1) caustic soda, due to the electrolysis of salt on the occurrence of a leakage of direct current; (2) lime in concrete and mortar; and (3) alkaline waters, due to calcium carbonate.

With regard to lead-sheathed cables, there are very few corrosive agents which will attack lead. Those which do so form a protective coating on the lead, if not subjected to external electrolysis. There have been a few cases of corrosion of lead sheathing in mines, but expert examination always reveals (1) that the corrosion is the result of chemical action aided by electrolysis, and not of chemical action alone; (2) that corrosion is almost confined to direct-current circuits only; or (3) that the lead has not been made continuous and connected to earth. In two-phase and three-phase work, the writer has never known a case of electrolytically corroded lead, and if such corrosion occurs at all, it must be very rare. It can be said, with entire confidence, that corrosion of the lead sheathing due to electrolysis cannot occur on alternating or direct-current circuits if the Home Office requirements for the continuity and earthing of the lead and armour on cables are adhered to.

The writer has no desire, on the present occasion, to reopen the controversy between the advocates of paper and bitumen insulation. He would only plead for the very highest standard of cable work in mines, whether copper or aluminium conductors are used, and indicate his personal preference for paper-insulated lead-sheathed cables. It may be taken as a general rule that such cables amply repay all the care in manufacture and installation that may be lavished on them. They will then form the most reliable part of the electrical installation, just as they have proved to be in traction, power, and lighting undertakings.

(i) **Cables with Copper Conductors.**—These are so well understood that it is difficult to say anything new about

them, but it is thought that the following information will be helpful to mining engineers.

It is sometimes noticeable in technical papers that all reference to cost is omitted. This seems, in many instances, to be an error of judgment, as it is desirable that every practical aspect of any problem should be given. Bearing this in mind, several tables have been drawn up here which, it is hoped, may prove useful in deciding what type of cable shall be installed in any given case. The first table (III.) compares directly the relative prices of low or medium-pressure three-core copper conductor shaft-cables (a) paper-insulated lead-covered double-wire armoured, taped, and compounded; and (b) vulcanized-bitumen insulated double wire armoured, taped, and compounded:—

Table III.—Comparison of Prices of Three-core Medium-Pressure Paper and Bitumen-insulated Shaft-Cables

Area Square Inch	(a) Paper-insulated	(b) Bitumen-insulated
0.05	1.00	1.19
0.10	1.00	1.15
0.25	1.00	1.13

Table IV. gives the relative prices for various low or medium-pressure three-core cables with copper conductors for in-bye use.

Table IV

Description.	Sectional Area, in Square Inches. 0·05	0·10	0·20
(*a*) Paper insulated with sector cores, lead-sheathed and single-wire armoured	1·00	1·00	1·00
*(*b*) Paper insulated with sector cores, vulcanized-bitumen sheathed and single-wire armoured	1·10	1·09	1·06
(*c*) Vulcanized-bitumen, insulated, with round cores and single-wire armoured	1·18	1·15	1·12
*(*d*) Paper insulated with sector cores, vulcanized-bitumen sheathed and double-wire armoured "leadless" cables	1·40	1·31	1·22
*(*e*) Vulcanized-bitumen, insulated, with round cores and double-wire armoured	1·48	1·38	1·29

* These cables could also be used for shaft-work.

(ii) **Cables with Aluminium Conductors.**—Seeing that aluminium cables have not been used in mines in this country, it is necessary to examine the evidence for them critically. Apart from several short lengths of aluminium cables, the most important cases in which they have been used in this country are as follows, and it is within the author's knowledge that they work quite satisfactorily:—

(1) The Manchester Corporation Electricity Department has over 11,000 yards of single-core paper-insulated lead-sheathed cable in use, chiefly of 1.66 square inch area, at varying pressures up to 600 volts as direct-current traction and lighting feeders. Some of the cable has been in use for nearly four years.

(2) The Bolton Corporation Electricity Department has had 1,440 yards of single-core 1.66 square inch paper-insulated lead-sheathed cable in use as low and medium-pressure direct-current feeders for over three years.

(3) The Metropolitan Electric Supply Company, Limited, London, has in use about 6,000 yards of 0.83 square inch medium-pressure concentric and triple concentric paper-insulated lead-sheathed cable.

Other users of aluminium cables include the County of London Electric Supply Company, Limited, Ealing Corporation, and the Stanton Iron Works Company, Limited.

In Europe, chiefly in France, Germany and Switzerland, extensive use has been made of these cables in the streets. The writer has seen a list of places in which over 800 miles of cable are employed at voltages varying from 240 to 60,000 (single-phase). The City of Zurich alone has 238 miles, while the Paris General Omnibus Company has in use armoured single-core tramway feeder-cables involving the use of 300 tons of aluminium, and has on order cables amounting to a further 300 tons. There seems to be, therefore, sufficient evidence already in existence to justify the use of aluminium cables where there is a saving in cost.

(iii) **Comparison of Prices of Insulated Copper and Aluminium Cables.**—At the time of writing this paper (March, 1913) the market values prevailing have been used in working out the comparative prices of insulated cables as follows:—

	£	s.	d.
Copper (electrolytic wire bars), per ton of 2,240 lbs.	69	5	0
Aluminium " " " "	90	10	0

The price of copper stated above is about 5 per cent. higher than the average price for the last 15 years, during which period it has fluctuated between £54 and £122 per ton. On the other hand, aluminium has fallen from about £200 per ton to the above figure, after making a somewhat artificial drop to £60.

In order to make an effective comparison between the prices of insulated cables with copper and of those with aluminium conductors, it will be convenient to consider fully some types and sizes of cables which are commonly employed in three-phase and continuous-current work.

For three-phase work at low and medium pressures a 0.10 square inch three-core paper-insulated lead-sheathed cable with copper conductors has been selected. The equivalent aluminium cable will, as has been seen, have a sectional area of 0.166 square inch. In Table V. those under division 2 are suitable for in-bye use; while those under division 3 are for shaft or in-bye use.

Table V

Description.	(1) Plain lead-sheathed. 0·10 square inch three-core Copper	Equivalent Aluminium.	(2) Single-wire armoured. 0·10 square inch three-core Copper	Equivalent Aluminium.	(3) Double-wire armoured. 0·10 square inch three-core Copper.	Equivalent Aluminium
When aluminium wire bars are £22 per ton above the price of copper wire bars	1·00	1·00	1·00	1·035	1·00	1·055
When aluminium bars are £10 per ton above copper bars	1·00	0·96	1·00	1·00	1·00	1·03
When aluminium and copper bars are the same price per ton	1·00	0·93	1·00	0·98	1·00	1·00
When aluminium bars are £10 per ton below copper bars	1·00	0·90	1·00	0·95	1·00	0·98

From the foregoing table it will be seen that the aluminium cable is the cheaper:—

(a) In plain lead-sheathed cables whenever aluminium wire bars are less than £22 per ton above the price of copper bars.

(b) In single-wire armoured cables whenever aluminium wire bars are less than £10 per ton above the price of copper bars.

(c) In double-wire armoured cable whenever aluminium wire bars are lower in price than copper bars.

For continuous-current work, at low and medium pressures, a similar comparison will be found in Table VI. between a 0.30 square inch copper single conductor paper-insulated lead-sheathed cable and the equivalent 0.50 square inch aluminium cable.

Table VII. is similar to Table VI., and gives a comparison of the same conductors but bitumen-insulated, etc.

Table VI

Description.	(1) Plain lead-sheathed		(2) Single-wire armoured		(3) Double-wire armoured	
	0·30 square inch Copper	0·50 square inch Aluminium	0·30 square inch Copper.	0·50 square inch Aluminium.	0·30 square inch Copper	0·50 square inch Aluminium.
(*a*) When aluminium wire bars are £42 per ton above the price of copper wire bars ...	1·00	1·00	1·00	1·043	1·00	1·07
(*b*) When aluminium bars are £22 per ton above copper bars ...	1·00	0·92	1·00	0·983	1·00	1·015
(*c*) When aluminium bars are £10 per ton above copper bars	1·00	0·89	1·00	0·955	1·00	0·99
(*d*) When aluminium and copper bars are the same price per ton	1·00	0·855	1·00	0·930	1·00	0·97
(*e*) When aluminium bars are £10 per ton below copper bars ...	1·00	0·825	1·00	0·903	1·00	0·945

Table VII

Description	(1) Braided only.		(2) Single wire armoured.		(3) Double-wire armoured	
	0·30 square inch Copper	0·50 square inch Aluminium.	0·30 square inch Copper.	0·50 square inch Aluminium.	0·30 square inch Copper.	0·50 square inch Aluminium.
(*a*) When aluminium wire bars are £42 per ton above the price of copper wire bars ...	1·00	1·00	1·00	1·033	1·00	1·05
(*b*) When aluminium bars are £22 per ton above copper bars ...	1·00	0·93	1·00	0·98	1·00	1·005
(*c*) When aluminium bars are £10 per ton above copper bars ...	1·00	0·90	1·00	0·955	1·00	0·985
(*d*) When aluminium and copper bars are the same price per ton	1·00	0·865	1·00	0·93	1·00	0·965
(*e*) When aluminium bars are £10 per ton below copper bars	1·00	0·835	1·00	0·91	1·00	0·945

Attention should be particularly directed to the comparative figures for unarmoured cables in division 1 of Tables V., VI., and VII., because there are installations where economies can be effected by using such aluminium cables on the surface works only, especially when the generating station or sub-station is situated at any considerable distance from the shaft. It should be stated briefly, also, that with larger sizes of unarmoured continuous-current cables, the saving is greater than is shown in Tables VI. and VII., and that unarmoured concentric and triple concentric aluminium cables for pressures up to 650 volts usually show a considerable saving over the equivalent copper cables. One such case came under notice this year, where a triple concentric aluminium cable showed a saving of 20 per cent. over the corresponding copper cable.

For 3,000-volt three-phase cables a similar close investigation has not been made, but it is instructive to examine the case of a 0.20 square inch paper-insulated three-core 3,000-volt copper conductor lead-sheathed and double-wire armoured cable 470 yards long which was supplied to a colliery company, and to compare it with the equivalent aluminium cable. Table VIII. sets out the comparative prices and details of this cable and of the corresponding aluminium cable as at March, 1913.

Table VIII

	(*a*) 0·20 square inch Copper.	(*b*) 0·333 square inch Aluminium.
(1) Price	1·00 (unity).	1·11
(2) Net weight of length	144 cwts.	161 cwts.
(3) Size of drum	7 feet 8 inches in diameter by 3 feet 10 inches in width.	8 feet 2 inches in diameter by 3 feet 10 inches in width.
(4) Overall diameter	2·70 inches.	3·07 inches.
(5) Capacity in microfarads per mile at 60° Fahr.; 1 core to others and the sheath	0·70	0·80

This table clearly shows that the aluminium cable cannot compete in this case either in price or in weight. In the above example, if plain lead-sheathed cables had been permissable, the aluminium cable would have cost 4 per cent. more than the copper cable. It is instructive also to compare the prices of cables exactly similar to the foregoing, but with 0.10 square inch copper and 0.167 sq. in. aluminium conductors with the plain lead sheath, the aluminium cable would cost 4 per cent. less than the copper cable, but with double-wire armouring, the cost would be 2 per cent. more. These figures and the weights of the cables are set out in Table IX.

Table IX

Sectional Area.	0·10 square inch Copper		0·167 square inch Aluminium		0·20 square inch Copper		0·333 square inch Aluminium.	
Class.	"A"*	"DDE"†	"A"*	"DDE"†	"A"*	"DDE"†	"A"*	"DDE"†
Price	1·00	1·00	0·96	1·02	1·00	1·00	1·04	1·11
Approximate net weight per 470 yards, in cwts.	51	95	55	111	81	144	86	161

* Plain lead-sheathed cable.

† Double-wire armoured and tape-protected cable.

Frequently it is decided in three-phase mining work to "earth" the neutral point of the system ,and so reduce the working pressure between the conductors and the earth. This enables changes to be made in the design of cables which work at 2,000 volts and higher pressures, with consequent saving in first cost. At 2,000 and 3,000 volts, three-core cables built for "star" working are cheaper than cables for "delta" working by about 0.5 per cent. on small cables of 0.025 square inch, and by about 1.5 per cent. on cables of 0.30 square inch. At 6,600 volts, the corresponding savings would be 3.00 per cent. and 10.00 approximately.

(iv) **Comparison of Weights of Insulated Copper and Aluminium Cables.**—Supplementing the information already given for 3,000-volt cables, Table X. gives some comparative data for different types of low and medium-pressure vulcanized-bitumen double-wire armoured cables (both with copper and aluminium conductors) which can be accommodated on a cable-drum not exceeding 4½ feet in diameter and 3 feet between the flanges. This information should be of assistance in planning out work below ground. Similar

Table X

Sectional Area of Cable.	Size of Drum.			Copper Conductors.		Aluminium Conductors of Equivalent Section	
	Barrel.	Flange.	Width between Flanges	Length of Cable on Drum.	Approximate gross weight of Cable on Drum.	Length of Cable on Drum.	Approximate gross weight of Cable on Drum
Square Inch.	Inches	Inches	Inches.	Yards.	Cwts.	Yards	Cwts
0·025 single	20	42	36	570	25	512	23½
,, twin	24	42	36	227	20	187	19
,, three core	24	42	36	198	20½	170	19
0·050 single	20	42	36	490	25½	438	24
,, twin	27	42	36	144	17¾	114	16½
,, three core	27	42	36	126	18¼	105	16¼
0·100 single	24	42	36	230	22	265	19½
,, twin	33	45	36	88	15½	69	14½
,, three core	33	45	36	78	16½	61	14½
0·250 single	27	42	36	190	20¼	166	18¾
,, twin	40	54	36	84	24	65	20½
,, three core	40	54	36	76	25	58	20

figures would hold good for paper-insulated lead-covered double-wire armoured cables, which are usually smaller in diameter than vulcanized-bitumen-insulated cables, although somewhat heavier.

(b) **Overhead Lines.—(i) General.**—As with cables, overhead lines should be constructed with the best available materials and workmanship throughout, and then they will prove to be very reliable in practice. Usually they are considerably cheaper than insulated cables, and the saving that may be effected frequently is as much as 50 per cent.

For overhead lines the copper or aluminium employed must be hard-drawn, and it is customary to use a stranded conductor, because its breaking-strain is greater than for a solid conductor of equal cross-sectional area. It is also usual to employ the smallest practicable number of wires in a strand so that each wire may be made to take its proper share of the longitudinal stress; but it is not advisable to use any aluminium wire exceeding 0.25 inch in diameter; and in conductors up to 0.25 square inch no individual wire should exceed 0.169 inch in diameter. Wherever it is desired to protect either metal from corrosion, etc., servings of single, duplex, or treble weather-proof compounded braid should be provided. In these cases, the extra windage surface of the lines, their increased weight, and possible extra collection of snow, should be allowed for in designing the poles, etc.

There are legitimate differences of opinion as to factors of safety for copper and aluminium wires. The practice varies widely: for example, in North America, where both aluminium and copper overhead lines are extensively used, the maximum stress employed for both copper and aluminium is 250 per cent. greater than is called for in the British Board of Trade regulations. Making allowance for the elasticity of the metals, experience shows that in most parts of the United Kingdom it is sufficient to allow 17 pounds per square foot of wind pressure and a factor of safety of 3½ for copper and 4½ for aluminium.

Experience has shown in North America that there is much less trouble with aluminium than with copper from ice and snow collecting on the conductors; and if in the future it can be demonstrated that aluminium does not collect these as readily as copper does in this country, then modifications in pole design, etc., will follow, with a further saving in cost in favor of aluminium. Aluminium conductors, being very light and of larger diameter than copper, are blown up vertically as well as horizontally in strong gusts of wind, and they require to be amply spaced, which increases the cost. So far as the author knows, copper wires in this country are never blown in any other direction than sideways.

Two frequent arguments against the use of aluminium are (a) that aluminium has an uncertain scrap value; and (b) that there are considerable difficulties in jointing the metal satisfactorily. This latter point has already been fully dealt with. In regard to (a), at one time there was a difficulty in selling scrap aluminium, but now there is none. Clean, commercially pure aluminium scrap, as obtained from cables or from overhead lines, can readily be sold at about £22 per ton below the market price of aluminium-wire bars, whereas the price of clean electrolytic copper scrap is about £6 per ton below the price of wire bars.

The writer is aware of three cases in which aluminium conductors were erected in the United Kingdom during the past ten years, with unsatisfactory results and has been at some pains to investigate them. He is of opinion that these failures were solely due to (a) inferior metal and insufficient knowledge of working it at the time; these causes no longer exist, and (b) inexperience in erection; there is now, however, sufficient experience to draw upon, so that there need be no fear of difficulties from this cause.

Summary

(1) Up to the present, aluminium has not made any serious impression on the use of copper for electrical work in the United Kingdom, but it is coming increasingly into favor.

(2) The initial difficulties in regard to the purity of aluminium, methods of working it, etc., have been overcome, and it can be safely used, as a conductor on an equal footing with copper.

(3) For mining work in the United Kingdom, at the present prices of copper and aluminium insulated cables with copper conductors and for all pressures are the cheaper, while, for overhead lines, aluminium conductors are the cheaper.

(4) Paper-insulated lead-sheathed cables are cheaper than bitumen-insulated cables, whether the conductors be of copper or of aluminium.

(5) Both copper and aluminium conductors can be efficiently jointed by well-proved methods.

Held Convention in Vancouver

The fifth annual convention of the Pacific Claim Agents Association was held in Vancouver, B.C., July 10-12. The organization includes among its membership practically all of the electric and steam railways on the Pacific coast. This was the first time the convention has been held in Canada, and although the location of the convention city at the extreme north of the territory covered was such as possibly prevented a full attendance, about 25 claim agents were present, the representation covering the coast cities from Los Angeles, north, and from Spokane, west. Among the visitors to the convention were Mr. E. Daggett, chief commissioner of the State Commission at Washington, dealing with matters connected with the state workmen's Compensation Act, who gave a very full explanation of the manner in which this act was working out both to the advantage of employer and employee. Papers read at the convention covered all phases of the work of the claim agent's office, including such subjects as "The Value of Safety Committees and the best type of organization;" "The value of index bureaus in connection with fradulent claims;" "Unreported accidents;" "Workmen's compensation and industrial insurance," etc.

The sessions of the convention were held in the general hall of the B. C. Electric Social Club, the convention being welcomed to the city by Mayor Baxter and Mr. F. R. Glover of the B. C. Electric, the latter taking the place of general manager Sperling, who was detained from attendance on account of business engagements. A number of the delegates were accompanied by their wives and families, the entire party numbering about fifty. The B. C. Electric provided entertainment for the party from the moment of its arrival until the close of the cenvention, every hour of the day and evening being filled with auto rides, interurban tram trips or launch rides to various points of interest about the city.

The Largest Gas Engine

The Ford Automobile Company are installing what is probably the largest gas engine in the world, at their works in Detroit. There are four double acting cylinders 42-in. x 72-in., two in tandem upon each side, held together with four 6-in. tie-bolts. The engine is designed to run at 85 r.p.m. or 1020 ft. of piston speed. The length of the engine from the front of the pillow block to the end of the tail-rod extension is 73 feet and its over all width is 32 feet. The crankshaft is 32 inches in diameter and 25 feet long and carries an 80-ton fly wheel and the armature of a 2,500 kw. generator. The generator is capable of carrying a 25 per cent. overload and the engine is rated at 5,000 h.p.

Electric Railways

Description of Five 50-Ton 600-1200 Volt Electric Locomotives for Freight Service on the B. C. Electric Railway, Vancouver

Five 50-ton electric locomotives have recently been built for the British Columbia Electric Railway Company, Vancouver, B.C. These locomotives are intended for freight service, and are similar to a number of 60-ton locomotives recently constructed for the Southern Pacific Company. They are standard gauge, and are of the double truck type with a central cab of the steeple type. This type of locomotive, because of its flexibility and simplicity of construction, is reported to be proving very successful in freight, switching and industrial service where severe operating conditions are frequently met.

Each locomotive is equipped with four Westinghouse No. 308-D-3 box-frame commutating-pole 600-1200 volt railway motors, and Westinghouse type HB unit switch control. These motors are adapted to subway, elevated and trunk-line railroad service. Since they are high powered and of the commutating-pole type, heavy loads can be handled without encountering motor troubles that are incident to such conditions. They are also well adapted where 1200-volt direct current operation is desired, and for such service, two motors are permanently connected in series. The box-frame construction is claimed to offer decided advantages on account of its solid mechanical construction, effective protection, and the alignment of all parts and the commutating-pole feature makes it operate reliably and economically, for heavy overloads can be handled safely, and also a large range of over-voltage incident to the heavy service in which this equipment operates is permissable without serious consequences. Some of the special advantages claimed for this motor by the manufacturers are given below:—

Electrical.—(a) Sparkless commutation under all loads and voltages encountered in normal service; flashing trouble, brush and commutator wear are practically negligible. (b) Thoroughly insulated and easily accessible brush-holders are used. (c) Brush-holders cannot get out of alignment; easily assembled; (d) The brush-holders are provided with an adjustable spring tension which provides uniform brush pressure throughout the life of the brush. (e) Flat braided shunts of ample carrying capacity relieve the brush-holder springs of current, resulting in reduction in heating of brush-holder parts. (f) Effective protection and insulation of armature coils is provided. (g) Bolted commutator construction insures freedom from loose commutator of high bars. (h) Strap-wound field coils are used, which are held under 400 pounds pressure, by springs; the field coils are asbestos insulated between turns; no chafing, vibration or breakdown takes place in this construction.

Mechanical.—(a) Lubrication of oil and waste, separate gauging oil reservoirs; only filtered oil reaches the bearings. (b) Spider armature construction. (c) No broken or bent shafts. (d) Shafts easily removable. (e) Superior gear case suspension. (f) Box frame gives solid mechanical construction. (g) Extensions of the frame project over the axle largely carrying the weight of the motor; axle-cap belts are relieved of pounding.

The mechanical features of this motor are of interest. The frame is a one-piece steel casting with large openings bored out at each end to admit the armature bearing housings and for taking out the armature. The weight on the axle is carried almost entirely by a solid bracket which extends over the axle. The split of the axle caps is such that the weight of the motor is taken off the axle cap bolts, thus greatly reducing troubles at this point. The frame has a large lug or nose case on it, which by means of a truck suspension bar carries the weight of the motor except that part carried by the axles. Safety suspension lugs provided as an additional safeguard are so arranged that should the main suspension lug break the motor would drop but a fraction of an inch onto the truck suspension bar causing no trouble.

Axle bearing dust guards are provided consisting of sheet steel casings arranged between the axle bearing housings. The dust guards effectively protect the axle bearings against the entrance of dust and dirt and thereby increase the life of the bearings, gears and axles.

The bearing construction insures good lubrication at all times. Bearings of this design have established a life of 150,000 miles with oiling only once a month. At each inspection it is possible to gauge the oil by means of a chamber provided for this purpose which results in economy in oil. Each housing consists of three chambers, an oil reservoir, a waste pocket, and an overflow pocket. Oil is poured into the oil reservoirs which then, through a bottom connection, reaches the waste in the waste pocket. The oil then filters up to the bearing by capillary attraction, leaving all dirt at the bottom under the waste. The reservoir has ample capacity and is so located in the bearing housings as to be easily emptied and cleaned.

The unit switch control used is similar to that used extensively by many electric railways and electrified steam roads. This control is especially adapted to locomotive services where currents of high value are to be handled and broken, for, due to the inherent construction of the unit switch, there is positive action in the making and breaking of circuits carrying heavy currents, and, due to the high pressure between contacts made possible by closing all switches by compressed air, no overheating or burning is experienced.

The control equipment consists of the following apparatus: 2 master controllers; 2 switch groups; 2 reversers; 1 series-parallel switch; 1 line switch; 1 control resister; 2 hand operated change-over switches; 2 sets of storage batteries (10 cells, each set giving 20 volts). All these are enclosed in a wire cage supported by an angle iron frame work in the centre of the locomotive cab.

Grid resistors are mounted in the roof of the locomotive cab over the unit switch apparatus in a portion framed off and ventilated through the roof by two ventilators. Each of the two master controllers have three running matches on 600 volts and two on 1200 volts.

An interesting item of this equipment is a series-parallel switch. The switch is controlled by a single-pole double

throw knife switch at either end of the cab. On 1200 volts the connections are so arranged on the change-over switch that the series-parallel switch is in the 1200 volt position connecting two motors in series regardless of the position of the knife switch. On 600 volts, the connections on the change-over switch are so altered on changing over to the 600-volt position that the motors of each pair by means of the series-parallel switch may be thrown either two in series or two in parallel, where in the 1200-volt position the motors are two in series only. This is of particular advantage on 600 volts in accelerating heavy loads. The motors are first connected four in series until the train is started. The controller is then returned to the "off" position, and the series



Electric freight service on the B. C. E. R. system.

parallel switch thrown to connect the motors of each pair in parallel. The master controller is then operated to connect in "series parallel" and finally in "parallel."

In changing over from 1200 volts to 600 volts, the resistances are paralleled, and also the dynamotor circuits are adjusted for 600 volts. This is all done by the two change-over switches.

On these locomotives particular care has been taken in arranging the apparatus to facilitate ease of inspection and maintenance. By control equipment being centrally located it is accessible from all four sides. This is a distinct advantage to operating companies, since ease of inspection assists in reducing the maintenance. This control location of equipment in standard for Baldwin-Westinghouse locomotives, and well illustrates the advantages of the centralization of equipment.

Dynamotor-compressors are used to furnish compressed air for the brakes and controls. A blower fan attached to the dynamotor shaft furnishes the air for ventilating the main motors. One of these is mounted under each end hood. The dynamotor runs continuously but the air compressor does not run all of the time, it being stopped by a governor throwing the friction clutch out between the dynamotor and compressor. The dynamotor compressor supplies 600 volt current for the lights. A steel air duct built into the frame of the dynamotor compressor delivers air for ventilation to points directly over each motor where by means of canvas ducts the air is conducted to the motor. Two dynamotor switches are furnished, one for each dynamotor. Two transfer switches are used for transferring the lighting load from one dynamotor and the cab lights on the other. All wiring is put in conduit. A complete combined straight and automatic air-brake equipment with two compressors, each having a displacement capacity of 35 cu. ft. of free air per minute, is included in the equipment for each locomotive.

The mechanical parts were built by the Baldwin Locomotive Works. The trucks of the locomotives are of the equalized pedestal type, with rolled steel side frames and angle iron frames. They have rigid centers, the bolsters secured directly to the side frames. The bolsters are of cast steel. The truck is kept square by heavy cast steel gaucet plates, which are bolted to both side frames and bolster. The springs are half-elliptic, and of such length (44 in.) as to insure easy riding qualities. The wheels are steel tired, with cast iron spoke centers.

The frame is composed of four 15-inch longitudinal channels. These are strongly braced transversely, above the truck bolsters, by means of plate stays, which are riveted to the channels, frame bolster and floor plating. The channels are also braced transversely, midway between the truck centers. The end bumpers consist of steel plates 1-in. thick, to which the coupler pockets are bolted. The couplers are of the M.C.B. type, placed at standard height (34½ in.) above the rail.

The cab is of steel, arranged for double end operation. It is provided with end doors, and careful attention has been given to such details as hand-holds, steps and cab windows. A sloping hood is placed at each end of the locomotive. The floor of the cab is of steel plate covered with hard wood matched fibering. The equipment includes air and hand brakes on all wheels, air sanders, a pilot and head light at each end, a bell gong and air whistle.

These locomotives are designed to negotiate curves of 40 feet radius, when running without trailing loads. Their principal dimensions are as follows: wheel-base, rigid, 7 ft. 4 in., total 23 ft.; driving wheels, diameter 36 in.; journals 5 in. x 9 in.; width over all 10 ft.; height of top of car 12 ft.; length between coupler knuckles 35 ft.; weight, 100,000 lbs.

Norfolk & Western Railroad to Electrify

The Norfolk and Western Railroad, which extends from the tidewater at Norfolk, Va., to the coal fields of West Virginia, has contracted with the Westinghouse Electric & Manufacturing Company to supply all the electrical apparatus required to electrify the Bluefield-Vivian section of its line, some 85 miles in length. The carrying out of this contract will give form to one of the most important projects of steam railroad electrification yet undertaken. The contract calls for the manufacture and delivery of twenty-six 130-ton electric locomotives of the single phase, two phase type, together with all required power house generating machinery and transmission apparatus.

Single phase alternating current of a frequency of 25 cycles and at 11,000 volts pressure will be supplied to the locomotives through an overhead suspended trolley wire and will be the identical type of the overhead system that has long been successfully used by the New York, New Haven and Hartford Railroad on its main line, by the Boston and Maine in the Hoosac Tunnel, by the Grand Trunk Railway in the Sarnia Tunnel and by the New York, Westchester and Boston Railway and for which installations the Westinghouse Electric and Manufacturing Company have furnished over 100 locomotives. The Norfolk and Western single phase-two phase locomotives, besides being very large and of enormous hauling capacity, will embody many unique features and requirements of design which, it is expected, will result in their showing unprecedented flexibility and economy of operation.

The Bluefield-Vivian section serves the celebrated Pocahontas coal region, one of the largest coal fields in the world. The tonnage of coal handled amounts to 65,000 tons per day, necessitating trains weighing as high as 3,250 tons, and it is to facilitate the handling of this heavy traffic that the electrical operation has been decided upon. There are a number of grades on this section, the maximum being two per cent., and at the present three Mallet locomotives (the most powerful type of steam locomotives built) are required per train. One locomotive is used at the head of the train and two for pushing. Only two electric loco-

motives will be required for this service and the present speed will be doubled. The extent, therefore, to which this quick train movement will enlarge the capacity of the railroad is quite apparent.

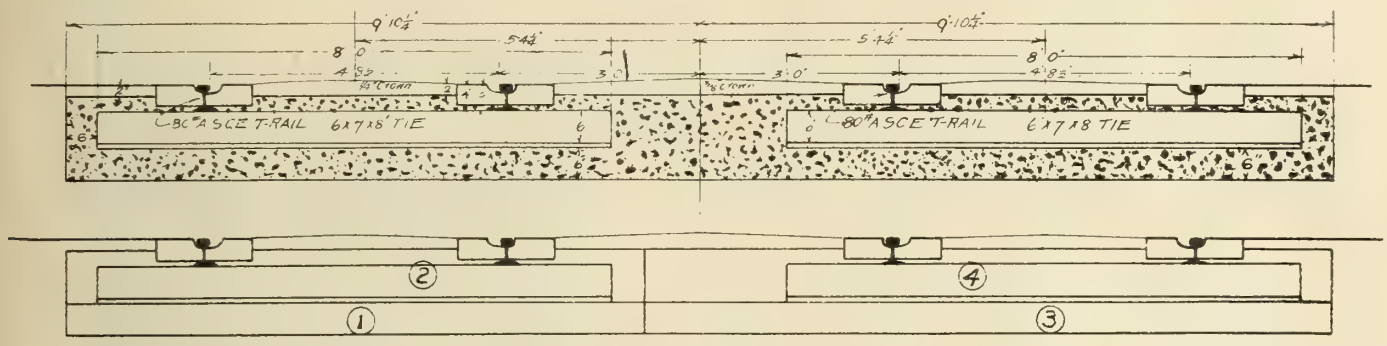
One of the present impediments to rapid operation of this section of the road is the extension of a 3,100 foot tunnel which is difficult to ventilate. This tunnel under electric operation will, of course, owing to the absence of smoke and noxious gases, offer no impediment to frequent train movement.

Since the Norfolk & Western locomotives are intended for handling what is known among railway men as "tonnage trains" they will be built for running speeds of approximately seven, fourteen and twenty-six miles per hour. The design of the electric equipment will be such that the tonnage can be readily increased in the future as the service demands. Power for the entire electrified section will be generated in a central power house located at Bluestone, West Virginia, with an installed capacity of 27,000 kilowatts in turbo-generators, supplied by the Westinghouse Company.

The traffic conditions of this section of the road are especially well adapted to electrical operation. It is in reality a separate engine division at present, and can be operated electrically without affecting the cost of engine service on other sections of the line. Conditions that are conducive to high economy in an electrification like that of the Norfolk & Western are:

1. Traffic requirements such that a minimum electrical equipment will give practically continuous service.
2. Fewer engine crews per train.
3. The speed of operation over the division will be nearly double that possible with present steam equipment.
4. Increased capacity of electrified section.
5. Electric locomotives are not limited to the short hours of service on account of boiler and fire conditions as in steam locomotives.
6. Watering and coaling delays incident to steam operation will be entirely eliminated.
7. The general reliability of locomotive operation will be considerably improved.

Work will be begun at once, and the contract calls for its completion in the summer of 1914.



Standard section of Calgary's municipal street railway double track—Lower figure shows order of placing concrete.

Track Construction in Calgary

The accompanying reproductions show the standard double track construction on paved streets of the city of Calgary's municipal electric railway system. This system now uses an 80-lb. A.S.C.E. rail, though previously they used a 60-lb. and 80-lb. Lorain I.T. rail. It was found, however, that these cost three or four dollars a ton more than the ordinary A.S.C.E. section. The rail block being used this year is a hard silicious sandstone which is set on a dry sand and cement cushion and then grouted. The plan followed is to lay the sub-base below the ties first and, when this is thoroughly set, to lay the track and bring it to line and grade by tamping sand under the ties. When this is completed the balance of the concrete is poured and the rail block set, the asphaltic concrete surface being then laid in the usual manner. A heavy joint is being used this year which goes below the flanges of the rail and is bolted through the web. In the past they have had considerable trouble with joints of the Calgary railway system, but they hope that this year's construction will overcome all difficulties. In previous years the concrete for the sub-base has not been laid separately—from the balance of the concrete—but the ties have been supported in position on blocks and the concrete poured right around them. In some cases this has given very satisfactory results, but in others, as already noted, the joints have shown signs of giving way, probably due to the pounding of the cars before the concrete had become very hard. A number double 4/0 bond at each joint with cross bonds about every 250 feet has been used. The intersection work has been supplied by Hatfield of Sheffield, the United States Steel Products Company, and by the Montreal Steel Works. Both the solid manganese steel and the manganese insert construction has been found satisfactory. This year they are having the tongues on the switches supplied with a double groove which promises to be very much more satisfactory than the older type narrow tongue switch, the narrow tongue, even when made in manganese steel, being very liable to get bent. Calgary's city engineer is Mr. Geo. W. Craig, and the superintendent of the street railway system is Mr. Thomas H. McCauley.

Miscellaneous

The temporary bridge over the ravine on St. Clair Ave. for the crossing of the municipal street cars has been approved by the engineers of the Ontario Railway & Municipal Board.

The Board of Control have fixed the fare on the St. Clair avenue lines, soon to be in operation, at 6 for 10 cents. This is the same rate as prevails on the other municipal line now operating, Gerrard street, though the distance will be greater.

A new kind of flooring is being tried out in one of the new cars just put into service by the Ottawa Electric Railway Company. It is called "mastic flooring," and is a preparation something like asphalt, but can resist over 400 degrees of heat before melting. It is put on over the ordinary wood floor in practically the same was as asphalt is put on the streets. The makers, the Canada Floors Limited, of Montreal, claim that their new product has several advantages over ordinary wood floors, namely that it is easier to clean, is more sanitary, better in appearance and almost everlasting. If it proves satisfactory it is likely all the cars owned by the Ottawa Electric Railway will be equipped with it.

Illumination

General Office Illumination

The photograph shown with this article illustrates the remarkable illumination in one of the general offices of Butler Bros., Chicago. The illuminating engineer may soon congratulate himself on the fact that by constantly hammering away at the same spot, he has at last made an impression on the modern office manager. The question of furnishing good illumination in offices now receives, in most cases, the same consideration as the heating, ventilating, air-washing and other requirements for the convenience and comfort of employees. The modern office manager realizes that proper lighting results in greater human efficiency and is thus a paying investment.

The Butler Bros. new building is the largest warehouse in Chicago. It covers one city block and is 15 storeys high. That this firm believe human efficiency is quite as important as machine efficiency is evident from the fact that no pains and expense were spared where the comfort of their many employees was involved. In line with this idea, the question of illuminating such spaces as the offices, salesrooms, restaurant, and merchandise offices, was given careful consideration. It is the obect of this brief paper to describe the results obtained with the indirect illumination which utlimately was decided upon and installed.

Fig. 1 shows a view of the general offices on the main floor. These offices are 150 ft. by 170 ft. an area of 25,500 sq. ft., and the 72 bays are illuminated by means of 288-100 watt indirect units equipped with X-Ray E-200 reflectors. This is a gross allowance of 1.15 watts per square foot. Some idea as to the diffusion of the light and the general uniform-



Fig. 1

ity of the resultant illumination may be obtained from this figure. The exposure for the photograph of this installation was made about six o'clock in the evening. The location of this section of the building is such that very little daylight is admitted even on bright days. The exposure was of thirty minutes duration. The ceiling is finished in a light cream with the columns and walls of a slightly dark cream down to about four feet above the floor. The lower wall is finished in a rich deep brown color.

The type of unit used in this installation is shown in detail in Figs. 2 and 3. The outer brass spinning for supporting



Fig. 2 Fig. 3

the silvered reflector is finished in what is known as "egg-shell" white (a mat white washable enamel). The pendant socket and the canopy are finished in a similar manner, and the reinforced lamp cord is also white. The construction of the lower brass spinning is such that for the cleaning of the reflector any of the supporting arms can readily be detached, as shown in Fig. 3. The reflector and lamp need not be removed from the fixture, and as these reflectors can readily be cleaned by merely wiping them with a damp cloth, cleaning labor is reduced to a minimum. In all, some 1,600 units of this same type are installed in the various offices and salesrooms of this building. Again because of the diffusion and uniformity of illumination, the employees are assured of maximum eye-comfort. There is no multiplicity of sharp an-

noying shadows, regardless of the position of the person, and there is little glare from glossy paper, desk tops and the like. Increased human efficiency must naturally be the result.

The initial cost of this installation is low. Originally it was planned to provide general illumination with 1-150 watt ceiling unit per bay, and to provide the required local illumination with desk lamps. With the indirect illumination 4-100 watt units are used above, but no desk lamps are required, since the indirect illumination is entirely adequate for the purpose. The cost of energy for operating this installation compares very favorably with any other that might have been installed. The investment and cost of operation of desk lamps has been eliminated. The cost of cleaning is very low, and lamp breakage is at a minimum, since the units may be cleaned without removing the lamp or reflector from the fixture.

Illuminating Engineering Society Convention

At a meeting of the general convention committee of the Illuminating Engineering Society recently held, arrangements were completed for the 7th annual convention of the society which will be held at Hotel Schenley, Pittsburgh, September 22nd to 26th.

The following program of papers has been decided upon:—

Mr. T. H. Amrine, of the Harrison Laboratory of the General Electric Company. Subject, "The Cooling Effect of Leading-in Wires Upon the Filaments of Lamps of the Street Series Type."

M. Georges Clause, of Boulogne, France. Subject:—"The Neon Tube Lamp."

Messrs. E. C. Crittenden and A. H. Taylor, of the Bureau of Standards, Washington, D.C. Subject:—"The Pentane Lamp as a Working Standard."

Mr. G. M. J. MacKay, of the Research Laboratory of the General Electric Company, Schenectady, N.Y. Subject:—"The Use of Nitrogen at Low Pressure in Tungsten Lamps."

Prof. F. K. Richtmyar, of Cornell University, Ithaca, N.Y. Subject:—"The Photo-Electric Cell in Photometry."

Dr. C. E. Ferres, of Bryn Mawr College, Bryn Mawr, Pa. Subject:—"The Efficiency of the Eye Under Different Systems of Illumination. The Effect of Varying the Distribution and Intensity of Light."

Mr. W. A. Darrah, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Subject:—"Some Theoretical Considerations of Light Production."

A paper by the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio. Subject:—"Errors in Photometric Measurements."

Dr. C. P. Steinmetz, of the General Electric Company, Schenectady, N.Y. Subject:—"The Development of Alternating Current Luminous Arc Lamps."

Mr. W. A. D. Evans, of the Cooper Hewitt Electric Company, Hoboken, N.J. Subject:—"The Quartz Mercury Vapor Lamp and Its Application."

Mr. V. R. Lansingh, of the Holophane Company, Cleveland, Ohio. Subject:—"Characteristics of Enclosing Glassware."

Mr. S. L. E. Ross, of the General Electric Company, Schenectady, N.Y. Subject:—"The Illuminating Engineering Laboratory of the General Electric Company at Schenectady."

Mr. R. B. Ely, of the Philadelphia Electric Company, Philadelphia, Pa. Subject:—"Church Lighting.

Mr. S. G. Hibben, of the Macbeth-Evans Glass Company, Pittsburgh, Pa. Subject:—"Modern Practice in Street Railway Illumination."

Mr. W. S. Kilmer, of the H. W. Johns-Manville Company. Subject:—"Hospital Lighting."

Mr. H. B. Wheeler, of the National X-Ray Reflector Company, Chicago, Ill. Subject,—"Window Lighting."

Mr. C. L. Law, Supt of the Bureau of Illumination, New York Edison Company, and Mr. A. L. Powell, of the Harrison Lamp Works of the General Electric Company. Subject:—"Distinctive Store Lighting."

Mr. J. E. Philbrick, of York, Pa. Subject:—"Some Commercial Aspects of Gas Lighting."

Mr. E. F. Kingsbury, of the Photometrical Laboratory of the United States Improvement Company, Philadelphia, Pa. Subject:—"A Problem in Church Lighting."

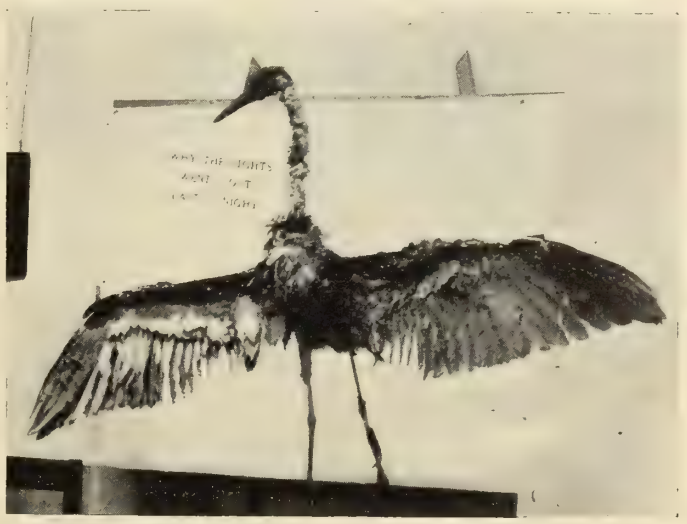
A paper by the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio. Subject:—"New Commercial Fields Opened by Recent Developments in Lamp Manufacture."

Mr. Roscoe E. Scott, of the National Electric Lamp Association, Cleveland, Ohio. Subject:—"The Evolution of Illuminants."

Dr. F. Park Lewis, President of the American Association for the Conservation of Vision, Buffalo, N.Y. Subject:—"The Psychological Values of Light, Shade, Form and Color."

Difficulties in Way of Good Service

The light and power service of the B. C. Electric in Vancouver, B.C., was interrupted recently because of a peculiar condition. A large heron was flying at night over the peninsula between the Fraser river and False Creek and in its course flew into the high tension wires of the company along the line of the Lulu Island railway. A short circuit was made, a foot of each of the three wires at the point being burned out, and the resulting surge temporarily putting the sub-station supplying current for Vancouver out of business. The cause of the short circuit was not known until the following morning when the linemen discovered the



dead heron lying at the side of the track. The B. C. Electric made good use of the dead heron from a publicity point of view. The bird was roughly mounted and displayed in the window of a newspaper office on the principal street of the city with a card hanging from its bill on which was printed, "Why the lights went out last night." This exhibit was visited by thousands during the afternoon and evening, the burnt leg and body of the bird showing at a glance the cause of the interruption to the service and thereby telling without further explanation the difficulties of a light and power company in maintaining an uninterrupted service over a large territory. Cuts of the bird were also shown in the daily papers of Vancouver, accompanied by explanations of the accident.

The Dealer and Contractor

Advertising, with Special Reference to Electrical Contractors

By Mr. P. L. Miles*

The aim of this paper is not to discuss the question. "Is it advisable for the electrical contractor to advertise," but rather to tell how new business may be secured by the use of advertising, properly directed. First of all, it is taken for granted that advertising, properly used, is of great value to the contractor in developing all phases of his business. This point as to the merit of advertising will admit of no argument today. Time after time its value to the wiring game has been demonstrated in various parts of this country. Actual results, in dollars and cents, have entirely settled this one-time question for good and all.

Probably an example is the best manner to illustrate the modern practice in advertising as adopted by the up-to-date electrical contractor. For this purpose, the schemes adopted by a contractor in a middle western town, of some 75,000 population, will be given.

This progressive contractor did a fairly good business in the wiring of houses, both old and new. In addition, he did a small amount of store and building wiring. He wasn't satisfied with his business, however, and looked around for ways and means of increasing his profits.

As a beginning he planned to develop his old house wiring business to the fullest possible extent. He called on the manager of the central station and made them a proposition —If they would furnish him with a list of 1,000 names of people owning unwired houses, these names to consist principally of people living in their own homes, he would circularize this list with advertising matter—more specifically, a series of letters with suitable enclosures. Very little argument was needed to convince the central station manager of the wisdom of supplying this list, as every house that was wired meant additional business for his company.

The contractor prepared a series of letters to be mailed to this list of 1,000 names. In these letters the propects were urged to wire their homes and let him do the work. They were told how many homes, in that particular town, he had wired—the quality of his work, and the reputation he aimed to maintain. With one of the letters a booklet was sent completely describing the operation of the wiring work, and the ease with which it could be done. With another letter a post-card was enclosed, which, when signed, would bring a salesman to give an estimate of the cost of doing the work.

Very soon inquiries began to come in, but there were no orders among them. The prospects wanted to know how much it would cost to do the work, as well as other information. The contractor soon realized that the advertising would not bring actual orders—the best that could be done was to secure inquiries. Yet he was entirely satisfied with these.

Here's what he found from his experience in this campaign:—That the advertising, no matter how carefully prepared, could not tell the prospects all they wanted to know. The information which they desired was—How much will it cost? Would you advise an outlet in the centre or side of a certain room? How about fixtures? How can it be arranged so that I can light my upstairs lights from down stairs? —and similar questions. All of these needed an inspection of the premises in order to give the correct answer, and could not be told by pamphlets or by form letters. An advertisement could tell how easily and neatly the work was done—how well equipped this particular concern was to do the work so far as careful workmanship and the best of material was concerned, and that there would be no injury to the woodwork or wall paper. The advertisement could likewise tell of the advantages of electric light and could arouse interest and eventually get the prospect to write for additional information, but that was all. After the inquiry had been received, it was largely a question of salesmanship to close the deal.

Soon Required an Assistant

The first few inquiries that came in as a result of the campaign were handled by the contractor himself. He had no man to take care of this work. But the work was too much for him; the inquiries began to come in faster than he could handle them. So he hired a salesman to look after this business for him. First of all, the salesman called on all the inquirers and met with good success in bringing in contracts. Finally all the inquiries were taken care of and the salesman found some spare time on his hands.

The contractor then reasoned—"My advertising may have interested several of the prospects, yet they have not been sufficiently interested to go to the trouble of writing for additional information. People, as a rule, dislike to write letters." So the salesman was started in calling on every one of the 1,000 people from whom no inquiries had been received. The scheme worked well. When the salesman made his call on the prospect and presented his card, the prospect was familiar with the firm he represented as well as his proposition of wiring the home. This much had been accomplished by the advertising.

In addition to the direct-by-mail letters, the contractor took a small space in one of the local newspapers and ran an advertisement three times a week. Very little was said in this advertisement other than giving the firm name, and making a statement that they specified in the wiring of houses. The aim was to acquaint people with the firm—in other words, general publicity.

The results of the campaign were fine. The following year the plan was repeated to those prospects who had not been induced to wire their houses. The contractor felt that these people would be nearer the "wiring point" after having been circularized the previous year with advertising material. He was a firm believer in the fact that every one of the prospects would eventually wire their homes and that

*Read at Electrical Contractors' Association Convention.

it was merely a matter of time before his concern could get them to contract for the work.

The salesman was, first of all, a good salesman. After his experience in this campaign he was much more valuable to the contractor on account of the experience he had obtained. The house-wiring campaign closed and there was little to keep the salesman busy except calling on the few inquirers that came in from time to time. The contractor was anxious to keep the salesman in his employ, and the only way that he could do this was to keep him busy.

The amount of business which he had done in wiring old houses had materially increased, while the wiring of new houses showed very little or no gain over the previous year. So it was decided to use the salesman to bolster up this end of the business.

Again the contractor figured—"This business is handled almost entirely by architects and general contractors. It would be a very easy matter for me to obtain a list of every one of these doing business in my city." From the telephone book's business directory such a list was prepared. A series of form letters was also prepared which were to be mailed to every architect and builder in the city. The contractor realized that the price and the quality of his work had a great deal to do with the obtaining of this business. Consequently the letters told of his reliability as an electrical contractor, the number of years he had been in business, and practically guaranteed them satisfaction if he obtained work from them. The letters also stated that the price was extremely low, taking into consideration the quality of material and workmanship. An opportunity to make an estimate on some of their work was asked.

Salesman Calls Regularly

The salesman then started to call on these people. Not calling once, but calling regularly every two weeks. In the last letter which was mailed it was stated that Mr. Salesman would call on them in the course of a few days. When this call was made they were familiar with the firm the salesman represented and with his mission in calling upon them.

The salesman made it his business to become personally acquainted with the men in these offices; his periodical calling gave him an excellent opportunity for doing this.

The contractor continued his small advertisement in the newspapers—the three insertions a week only costing him $2.00. These advertisements helped to bring the firm name before the architects and builders, and to give it a standing in the community. The architects and general contractors were furnished with self-addressed post-cards, which they could use in requesting that the salesman call on them in order to figure a piece of work.

Requests for bids on small wiring jobs began to come in. The work of wiring new buildings picked up tremendously. The salesman became well acquainted with the prospects. He brought his personality into play and in turn brought in the business. Here was another profitable field which advertising, combined with good salesmanship, has conquered.

(To be continued)

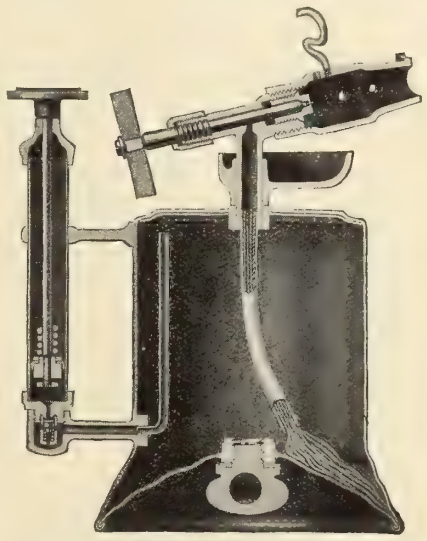
Reacto Horns

A high-grade electric horn of the vibrating type has recently been introduced on the Canadian market by MacKeen Company, 404 Unity Building, Montreal. This horn is constructed on an entirely new principle, with the result that it emits a very different sound from other vibrating types. The armature or hammer strikes the steel diaphragm on its return or re-acting stroke. The action is very quick, so quick in fact that it has not the slightest damping effect on the vibration of the diaphragm, and resulting tone of the horn. The tone is clear, loud and penetrating and free from that abruptness or squawkiness which characterizes many horns. Practically all sparking is done away with, as a condenser is bridged across the circuit. The horn is weatherproof and all the steel and iron parts are, copper-plated to prevent corrosion.

The Reacto horn is exceptionally well made and of excellent appearance; the standard finish is baked black enamel with inside surface of the projector finished in nickel. A high-grade nickel push button with water-proof cord is supplied with the ordinary equipment, and when specified a sufficient length of nickel flexible tubing can be supplied for steering post attachment. This horn measures 11 inches over all and the bell mouth of the projector measures 7 inches, the approximate weight being 7 pounds. It is manufactured by the Holtzer-Cabot Electric Company of Brookline, Mass.

A Universal Blow Torch

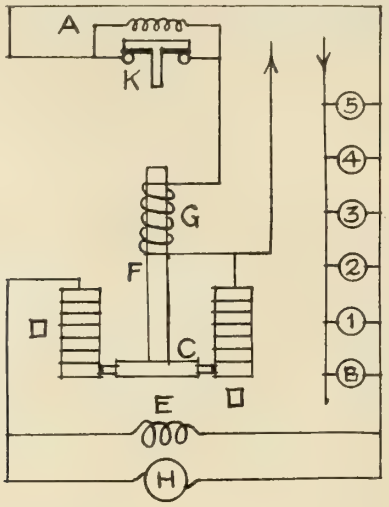
A new gasoline blow torch has recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which embodies a number of novel features and improvements. These improvements, it is claimed, adapt the torch for all conditions of service and it is therefore called a Universal Blow Torch. A cross-sectional view of the torch is shown in the accompanying illustration. The burner is made particularly heavy so that it will retain its heat and keep the torch burning in cold or windy weather.



The drip cup is made especially deep so that it will start the torch under bad weather conditions. These features, however, do not detract from the use of the torch for indoor work. Another feature is the self-cleaning burner valve. The needle at the end of the valve stem cleans the hole automatically when the valve handle is turned. The valve seat therefore need never be injured by picking at the opening to clean it. The valve seat is a separate replaceable plug. The handle of the valve is of fibre. This handle does not get hot nor does it need a long valve stem for cooling as does an iron handle. On the other hand it will not crack, loosen and come off as does a wooden handle. It does not char or burn. The tank it is claimed, is of the heaviest gauge brass ever used for torch tanks and is reinforced with an extra corrugated brass disc covering the entire inner surface of the tank pot. This insures the tank keeping its shape under very rough handling. The pump valve works in a cylindrical guide which assures the perfect seating of the valve. It can be taken apart and any part replaced separately. The illustration shows the quart size of torch. A pint size is also furnished which differs only in the shape and size of the tank.

Control of Suction Cleaners

The diagram shown herewith is illustrative of a motor driven suction cleaner installation recently completed in the Cecil apartments, Jarvis street, by the Elevator Supply Company. Direct current is used. In the diagram, B. 1, 2, 3, 4, and 5 represent push buttons on the different floors arranged in multiple. E. & H. representing the field and armature respectively of the motor. D D are carbon resistances. G is a solenoid operating a soft iron core F on the base of which



is a hollow metal box C which closes the circuit between the carbon resistances by means of two small brushes. A is a resistance of about 200 ohms and K a metal piece for cutting out the resistance A.

When the current is first introduced it passes through which ever one of the push buttons has been closed and divides, part going by the upper route through K and part by the lower through the carbon resistances, etc. The current in G is sufficiently strong to raise F, gradually cutting out the resistances D D and, as the highest point is reached, raising the contact piece K. After this only sufficient current is allowed to pass through G, as a result of the resistance A which has been cut in, to hold the magnet F in its working position, that is, cutting out the resistance in the lower circuit except that of the armature and the field itself.

New O-B Overhead Materials

The Ohio Brass Company, of Mansfield, Ohio, have added to their line of overhead materials the new designs shown herewith. The cross-over shown in Fig. 1 is intended for use at crossings where it is not desired to insulate the wires from each other. The feature of the device is the method of holding the wires in place by means of the cam action of the renewable bronze tips. This principle has been used on O-B frogs for some time and has proved to be not only an efficient means of holding the wire but also a time saver for the lineman. The bronze pan and cross runner castings interlock and are held together without the use of screws or bolts. Installation of the device is simple and is accomplished without cutting of wires. Two forms are made; form 1, with malleable iron deflector bars to prevent a flying trolley harp from being wedged, is used for crossings of from 30 to 60 degrees, while the form 2, without deflector bars, is for crossings from 60 to 90 degrees, since, within these latter limits, there is no danger of a harp catching. For the present, these crossovers will be furnished in bronze for 2/0 round, figure 8 and grooved wires only.

The bronze splicer shown in Fig. 2 is an entirely new design known as the type C. It combines lightness, strength, clearance for trolley wheel and smooth under-run. The lips at each end of the splicer are bent around the wire, completely encircling it and protecting it throughout the entire length. There are no hollow places in the under side to cause arcing. Installation is easy as the wire is practically straight throughout the entire length of the splicer. The set screws are made of tool steel and are amply large to withstand severe strains. Their holding power is increased by forcing the wire into slight depressions under each screw. Tests have shown that the wire will break before it will slip from the splicer. For the present, this splicer is made for 0 and 2/0 round and grooved wires only.

The type A, form 2 section insulator shown in Fig. 3, was developed as a result of the popularity of the type A, form 1, which has been on the market for a number of years and has been in steady demand. The new design is similar in every way to the old except that it is smaller and lighter. It is recommended for 0 and 2/0 round, figure 8, and grooved wires, while the old heavier design is offered for the 3/0 and 4/0 wires. The insulator is shown with suspension yoke attached to boss, but is furnished with the boss only when it is desired to attach the insulator to the trolley hanger.

The trolley clamp shown in Fig. 4 is made with a pressed steel runner piece, 7¼ in. long, and cast boss. It is light in weight, fits the wire tightly and gives more clearance for the trolley wheel than the ordinary cast clamp. The boss and runner piece are held together by four screws which also tighten the clamp onto the wire. The weight of the trolley wire is supported by two small lugs on the boss castings which fit into a hole in the runner piece and are held by the screws.



Fig. 1—Type E Adjustable Cross-Over Form 1, with Deflector Bars



Fig. 2—Type C Splicer—Patent Applied For



Fig. 3—Type A, Form 2 Section Insulator



Fig, 4—Pressed Steel Trolley Clamp

New Rain-proof and Sleet-proof Pulley

The new "Kyle Line" long-skirted pulley, made by the Line Material Company, South Milwaukee, Wis., is completely covered both front and back, to keep out snow, sleet and rain. Inside of this enclosing case, guide ridges forming a part of the casting, guide the knob of the rope clamp as it is raised, so that the weight of the lamp is finally taken from the rope and is supported by pulley ridges. In the accompanying illustration, in which one side of the enclosure is



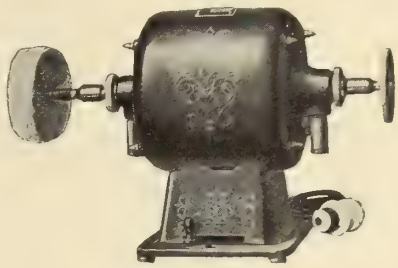
cut away, the guide ridges can be seen and the rope clamp is in the final position. The rope clamp has rounded edges, and offers protection to the rope on both sides from scraping against the pulley. The small clamp can be used with chain or rope. The pig-tail hook, which is a part of this clamp, allows the lamp to be attached with one hand. These safety pulleys are made with five standard types of top clamps for suspension from mast arm, outrigger, ceiling and span wire. In the suspension of span type clamp, as shown in the illustration, the groove for the wire or cable is opposite to that assumed by the span, so that the pulley locks itself in the position in which it is installed and cannot move along the rope. These pulleys are being used with arc lamp insulators, and hangers of all types.

Have a Montreal Office

The George H. Shuman Electric Company, New York, have opened a Montreal office at 1010 New Birks Building, Mr. William Ile being appointed Canadian manager. The company are electrical contracting engineers, and have carried out some extensive contracts. In addition they are the distributing agents for Canada of the Ile-drawn tungsten lamps, which are guaranteed. The company are also making a feature of metallic art fixtures, made of asbestos and plaster, fireproof, and manufactured in various colours.

A New Dental Lathe

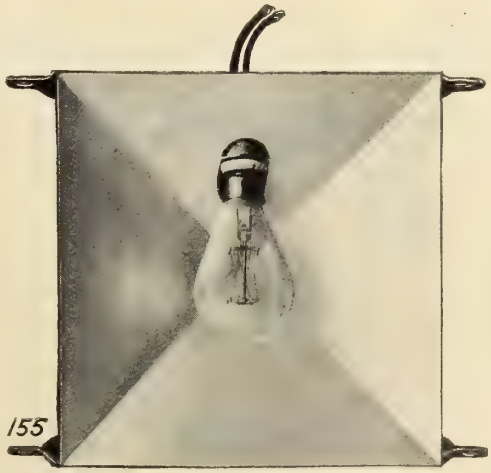
The Westinghouse Electric & Manufacturing Company have just placed on the market a new electric lathe specially designed for the use of dentists. It is made for operation on either direct of alternating current lighting circuits and is rated at 1/6 h.p. Alternating current lathes have two speeds, and direct current lathes three. Speed changes are effected by a switch lever at the base, which has also an "off" position, so that the lathe can be stopped and started at the



work. The switch is built of material that is unaffected by moisture. The shaft is extended at both ends for mounting Ritter chucks which carry buffing and grinding wheels of various sizes, drills, burrs, etc. The chucks can be forced off the shaft by turning a knurled nut mounted on each bearing. A double groove pulley is furnished with each lathe. The bearings are specially designed for grinding service and are automatically lubricated by means of grease cups. All the working parts are enclosed and protected from dust and dirt. The finish is especially pleasing, being of glossy black Japan, ornamented in gold, with all bright metal parts nickel-plated.

New Wall Reflector

The Reynolds Electric Flasher Manufacturing Company of Chicago and New York are placing upon the market a specially designed reflector for painted walls, bulletins, billboards and signs of various description. The reflector is supported by wire cables, which in turn are fastened to cross arms at the top and bottom of the sign. A 100-watt mazda lamp is used, and the full force of the light is evenly distributed without shadows or dark spots over 15 square feet of sign surface. The reflector is porcelain enamelled on steel



and has a glassy, white reflecting surface on the inside and is blue on the outside. This material is practically indestructible. They are easily erected by any one, and many a sign which is only doing service in the day-time can be turned into a handsomely paying night advertisement by a small expenditure for reflectors and electric light current. This class of business opens up a large field for the central station manager. It is a desirable load, and any live business house should readily be induced to go into the proposition.

Current News and Notes

Athabasca Landing, Alta.

A recent fire wiped out practically the whole town, including the provincial government telephone exchange.

Battleford, Sask.

The municipal electric light management will erect within the next three months, two 250 h.p. engines, and two 250 h.p. boilers, with Westinghouse generators and switchboard, to increase the output of the present plant. The municipality will also purchase within the next three months material for six miles of transmission line. Mr. F. K. Martin is manager of the Battleford municipal electric system.

Brandon, Man.

The municipal street railway system showed a surplus of $4,000 during the month of July, gross being $8,430. This increase is partly the result of the Fair during which record crowds were carried.

Brockville, Ont.

Work has started on the installation of the ornamental standards in connection with the new street lighting system.

Brantford, Ont.

The contract has been awarded to Bennett & Bowden for the erection of a transforming sub-station in Brantford. The necessary transformers and switching equipment will be purchased by the Hydro-electric Power Commission of Ontario.

Cookshire, Que.

The Westbury Electric Light & Power Company of Cookshire, expects to erect within the next few months about 8 miles of transmission lines and to purchase a 200 kw. alternating-current generator, waterwheel governor and 100 watt-hour meters. The generated voltage will now be raised from 3,000 to 6,000 volts. This company is in process of reorganization into a joint stock company, capitalized at $75,000, Mr. H. A. Worby is manager, and Mr. Elmer Williams, electrician.

Calgary, Alta.

On August 18, the date on which the new Calgary store of the Hudson's Bay Company was formally opened, the entire street car system of the city of Calgary was handed over, for a consideration, to the Hudson's Bay Company. Between 2 o'clock and 6 o'clock in the afternoon no fares were collected on any part of the system.

Carlyle, Sask.

Contracts have been awarded in connection with the power house and generating equipments for the new electric plant as follows: Power house, reservoir and erection of compressor to Bennets, Debnam & Company; pumps, Caledonian Iron Works; generators, General Supply Company, Calgary; meters, Packard Electric Company; poles, McKinnon Lumber Company, Calgary; line material, Northern Electric Company; wire, Eugene F. Phillips Company; transformers, Canadian Moloney Electric Company; street lighting equipment, R. E. T. Pringle. The work is in charge of the Jno. Galt Engineering Company.

Edmonton, Alta.

It has been recently discovered that the city telephone department has suffered considerable loss through the alleged dishonesty of one of its former employees. The full amount has not yet been discovered, but it is not expected to be above a few thousand dollars.

The street cars are now operating over the new high level bridge which has been built over the North Saskatchewan river to connect North and South Edmonton.

It is understood that the first section of the Edmonton Interurban Electric Railway which will operate between Edmonton and St. Albert, will be in service within the next few weeks. Cars of the gasoline electric type will be used, the motive power consisting of a gasoline engine, operating a generator which in turn will operate the motors.

Elora, Ont.

The probable cost of a complete distribution system for the village of Elora is estimated roughly by the Hydro-electric Power Commission at $10,000.

Forest, Ont.

The electrical equipment for the new power plant in Forest is being supplied and installed by the Canadian Westinghouse Company, Limited, and consists of one 70 kv.a. alternating current E. T. generator, 3-phase, 2200 volts, 25 cycles, 500 r.p.m.; one 3½ kw., 125 volt, direct-connected exciter and a two-panel switchboard. Panel No. 1 is designed for the control of the generator and exciter, and panel No. 2 for control of a 12 kw., 2200 volt primary, 25 cycle, constant current regulating transformer. Both panels are mounted with all the necessary instruments.

Fort William, Ont.

Extensions to the development plant of the Kaministiquia Power Company are pending, but no definite decision has as yet been announced nor any tenders called nor contracts let. The nature and extent of these additions will depend somewhat on trade conditions and business prospects of the next few months. The present installed generating capacity has a nominal rating of 15,000 h.p. with overload rating of 22,000 h.p. The hydraulic development, including dams, intakes, forebay, etc., was originally installed for an ultimate capacity of 35,000 to 50,000 horse power.

The contract has been awarded for the construction of car-barn additions for the accommodation of the municipal street railway rolling stock. The cost will be about $40,000.

The city council have adopted a report of the Utilities Committee which recommend that power be sold for domestic purposes at a rate of 1½c. per kw. hour. There is, however, a meter rate of 25c a month attached as well as a minimum charge of $1 per month.

Fredericton, N.B.

The Fredericton Gas Light Company recently purchased a 375 kw. Westinghouse-Parsons turbo-generator which is about ready for shipment from the East Pittsburgh works of the manufacturer. A small direct connected engine-driven exciter is also included in the order. The condensing outfit is being supplied by the Wheeler Condenser & Engineering Company, and consists of one surface condenser with sufficient capacity to look after the exhaust of the above turbine, a circulating pump with a Kerr turbine to operate it, an Edwards air pump and other auxiliary equipment. The switchboard and necessary instruments are being supplied by the Canadian Westinghouse Company, and have already been delivered in Fredericton.

Granby, P.Q.

It is reported that a syndicate in which McCuaig Bros. are interested have purchased power sites on the St. Francis

river near Drummondville, where they can develop some 8,000 h.p. and that power will be transmitted to Granby providing an agreement can be arrived at with the municipality.

Galt, Ont.

The branch of the B. F. Sturtevant Company being established in Galt will not build electrical apparatus at the present time. The work will consist primarily of assembling fans, blowers and heaters, and of building sheet metal work. The castings and parts being sent from the Readville, U. S. A. shops.

Hamilton, Ont.

Tenders are being received by Mayor Allan for extensions to the conduit system in connection with the hydro-electric distribution.

Hull, Que.

The Hull Electric Railway Company held a Venetian Carnival at Aylmer recently which attracted over 2,000 people from Hull, Ottawa and places along the line.

Le Pas, Man.

The contract has been awarded for the construction of the building to house the operating equipment of the wireless station being installed here, for the Dominion Government, by the Marconi Telegraph Company. The contract goes to Coyle & Hughes, of Winnipeg.

Lindsay, Ont.

On September 3 a by-law will be submitted authorizing an agreement between the Light, Heat & Power Company and the municipality regarding street illumination. The company agrees to maintain the present system of 77 6.6 amps. carbon arc lamps and 18 6.6 amps. magnetite arcs for the annual sum of $5,200. If further lamps are required the prices will be as follows:—magnetite arcs $75, carbon arcs $50, 60 candle tungsten $12, per lamp per annum.

London, Ont.

It is probable a vote will again be taken on the question of operating Sunday cars. The date has not yet been set, but it will likely be with the other January elections.

Medicine Hat, Alta.

It is reported that active construction work in connection with the street railway system will be commenced in the very near future.

Montreal, Que.

The Hon. Jules Allard, Minister of Crown Lands for the province of Quebec, has received a petition signed by a large number of citizens of the Eastern Townships asking that the government build storage reservoirs to hold the waters of the St. Francis River in order to regulate the flow. They also ask that the Commission on Running Waters study the problem.

Tenders have been received for additional sections of the Montreal conduits. For the work on St. Catherine street from Atwater Avenue to Guy Street. Six tenders were sent in—L. A. Ott; G. M. Gest, Dietrich, Limited; Federal Engineering Company; C. E. Deakin; and Standard Construction Company. The other section is on Bleury street to Pine avenue, and for this three bids were made—G. M. Gest, Standard Construction Company, and L. A. Ott. Mr. G. M. Gest was the successful tenderer on both sections, his prices being the lowest in both instances. For the St. Catherine Street, Atwater Avenue to Guy Street section Mr. Gest's quotation was $45,969; time for the job two months. For the Bleury Street section, the price was $128,418; time four months.

Some controversy has arisen between the Outremont P.Q., Town Council and the Bell Telephone Company as to the payment of certain sums for the laying of the joint conduit. The amount is about $4,000, extras for which the company disclaimed responsibility. The company, however, agreed to allow Dr. Herdt, who designed the conduit, to arbitrate, and the council have decided to accept the suggestion.

Another extension of the Montreal and Southern Counties Railway is completed. This is to Marieville, four miles beyond Richelieu and 22 miles from Montreal. Much of the roadbed to St. Cesaire is also completed.

In connection with the Montreal conduit system, Mr. Parent, superintendent of lighting for the city, has prepared a report recommending a lighting system for the various streets. A number of artistic standards have been considered, and Mr. Parent has also made a study of the most suitable systems.

The Siemens Company of Canada have been awarded the contract to supply 41 motors ranging in capacity from 185 h.p. down, for the Acadia Sugar Refinery Company of Nova Scotia, in connection with their new plant. The motors are to be suitable for 3-phase, 60-cycles, 550 volt circuits.

A contract has been awarded to Mr. E. G. M. Cape, Montreal, for the construction of a new factory and offices for the Imperial Wire and Cable Company, Montreal. The building has been commenced on the site at St. Patrick street. The factory and offices will comprise several structures, the principal being one of eight storeys. When completed, the factory will be one of the largest and best equipped in Canada. The machinery will all be run by electric power.

Neepawa, Man.

The town of Neepawa will call for tenders in the near future for apparatus, consisting of two 150 horse power boilers and a generator unit of 125 kw. capacity, direct connected to a suitable engine. Plans and specifications are now being completed by W. E. Skinner, Limited, 204 Sterling Bank Building.

Newburgh, Ont.

The Sebley Telephone Company, Limited, has been incorporated with a capital of $5,000, to carry on the general business of a telephone company, with head office at Newburgh.

New Toronto, Ont.

By a recent vote the council was authorized to issue debentures to cover the cost of erecting a distribution plant.

Ottawa, Ont.

The application of the City of Ottawa for an order compelling all companies owning and operating overhead wires on the chief streets of the city, whether for electric light, telephone or telegraph, to be buried underground, will come before the Railway Commission at their first sitting in September.

Port Hope, Ont.

On August 25 a by-law was carried authorizing the agreement between the Seymour Power & Electric Company and the Corporation of the town of Port Hope. By the agreement the company supplies an electric street lighting service to the extent of a minimum of 340-60 candle power tungstens at an annual rate of $12. The company will spend about $10,000.

Prince Albert, Sask.

Owing to the general financial condition which has rendered it difficult for many municipalities to get the necessary money to continue their municipal work, the city of Prince Albert will temporarily suspend construction work on their hydro-electric development at LaColle Falls. The dam is already nearing completion and is understood to be in such

shape that the delay will not cause any deterioration of the structural work.

Regina, Sask.

The operating returns for the week ending August 2, show revenue $7,036.60 and the number of passengers, not including transfers, 166,311. For the week ending August 9 the figures were $3,909.30 and 91,782.

A contract has been awarded to the Canadian Allis-Chalmers Limited, for two motor driven centrifugal pumps of a capacity of 12,500 gallons per minute each.

Tenders will be received up to October 1st for boiler room equipment in connection with Regina's new power house.

Sherbrooke, P.Q.

The city recently acquired the Lomas power, on the Magog river, situated above the present municipal power station. This opens the way for a further development which may be rendered necessary in the near future, as the consumption of current for light and power is steadily increasing.

Souris, Man.

A by-law will be submitted on September 2nd authorizing the expenditure of $40,000 on an electric light and power plant.

St. Catharines, Ont.

The Chatfield Heating & Plumbing Company has been formed to carry on, among other things, the business of electricians, mechanical engineers and manufacturers.

Contract has been awarded to Newman Bros., St. Catharines, for the erection of a transformer station here for the Niagara, St. Catharines and Toronto Railway Company.

The by-law authorizing an agreement with the Hydro-electric Power Commission of Ontario, which was to have been voted on on August 28, has been postponed to allow further time to prepare certain necessary estimates.

St. Agatha, Ont.

Niagara power was turned on for the first time at this point on August 6. The supply line runs out from Berlin, which is eight miles distant.

Sudbury, Ont.

By a recent vote the electors were unanimously in favor of granting a franchise to the Sudbury-Copper Cliff suburban electric railway.

Swastika, Ont.

C. A. Foster, of Haileybury, contemplates the installation of a seven mile telephone line between the Swastika and Foster properties taking in all the mines along the way. A central station will likely be installed at Kirkland Lake.

Sandwich, Ont.

The frequent reports that a power plant is being constructed in Sandwich to operate in conjunction with the Detroit Edison Company are inaccurate. A small sub-station has been erected which presumably was intended to receive power by cable from Detroit, but up to the present time the Ontario Government has not given its consent to the importation of power at that point.

Toronto, Ont.

The Turbine Equipment Company, Limited, has been incorporated with a capital of $40,000, to carry on business as civil, mechanical and electrical engineers, contractors, etc., with head office at Toronto.

The Lancashire Dynamo & Motor Company will change their address, on September 1, from the Peterkin Building, Bay street, to 107-9 Duke street. In their more commodious quarters, rendered necessary by business expansion, they will have ample space for a store and show room and a small repair shop, in addition to offices.

Something over four millions of debentures in connection with the Toronto Hydro-electric distribution system have been placed with Messrs. N. W. Harris & Company, of New York. These debentures bear interest at 4 per cent. and the sale price was 83.

Valleyfield, Que.

An electrical fire alarm system is being installed at Valleyfield, P.Q., by Sevigny & Lalonde, Notre Dame Street West, Montreal. The equipment consists of Gamewell non-interfering Excelsior fire alarm boxes connected in series, supplied by the Northern Electric and Manufacturing Company. The town is divided into four districts, five boxes being installed in each division, these being connected to the central fire station and also to the waterworks. The system is worked by means of two closed metallic circuits, north and south, which can be used together, or separately in case of necessity. The electro-motive force for operating the system is furnished by gravity batteries, of sufficient power to give 1-10 ampere for each circuit. Lightning arresters are provided in each station, while a switchboard is installed in the central station. The gongs are of the 15 in. and 8 in. types.

Wallaceburg, Ont.

The Wallaceburg Gas Company are installing a new 250 kv.a. generator. This will be operated by a 150 h.p. gas engine on one side and the present steam engine unit on the other side. A change is also being made to 60 cycles and 24 hour service will begin on October 1 next. The Premier Electric Light & Power Company and the Consumers' Gas Company have amalgamated and are now known as the Wallaceburg Gas Company. Mr. W. R. Waghorne is manager of the company.

Wardner, B.C.

The electric power house of the Crows' Nest Pass Lumber Company at Wardner was recently destroyed by fire.

Winnipeg, Man.

The municipal system of the city of Winnipeg is at present being extended by the installation of two 5,000 kw. water turbine generator units. A single 9,000 kw. 3-phase transformer is also being installed. Up to the present time the transformer equipment at the generation station has been single phase built for 6,000 volts, but all future equipment will be installed for 110,000 volts, 3-phase. A second transmission line is also to be erected and work on the footings will be commenced in the immediate future. This will be a steel tower using suspension type insulators similar to those used on the Ontario Hydro lines. It is not the intention to use this line for 110,000 volts at the present time, but equipment is being installed for ultimate use at that pressure.

Welland, Ont.

It has been stated that construction work will be commenced this autumn on the plant of the Electric Steel and Metals Company, which is to be built here.

Woodville, Ont.

A by-law was passed on August 13th authorizing the expenditure of $4,000 on a distribution system.

Wolseley, Sask.

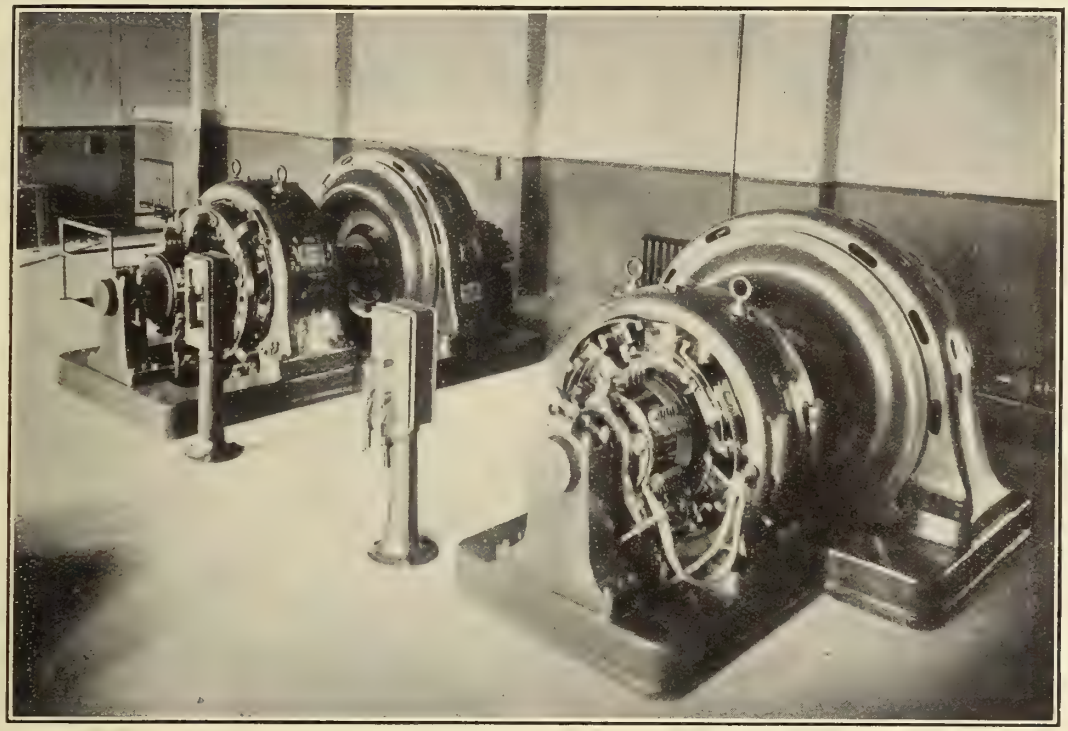
A by-law was submitted on August 20 authorizing the town council to purchase the plant of the Central Light & Power Company, Wolseley, Sask. The sale price is $14,000. Failing an agreement with the municipality the company will install a 30 kw. generator which will be belted to their auxiliary oil engine so as to relieve the present generator. It is also the intention to install, next year, a new 150 h.p. producer gas engine and a 90 kw. generator complete with a suction gas producer. Mr. Chas. Stengel is manager of the company.

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SIEMENS



One 400 K.W. and one 200 K.W. Siemens Self Starting Synchronous Motor Generators, supplied and installed for the City of Lethbridge

We have delivered or on order in Canada amongst others the following motor generators :—

1-800 K.W. Dominion Coal Co., N.S.
1-800 K.W. Canadian Collieries, B.C.
1-700 K.W. Canadian Collieries, B.C.
2-500 K.W. Winnipeg
2-500 K.W. Port Arthur
1-400 K.W. Lethbridge
1-250 K.W. Canada Sugar Refinery Co.
1-220 K.W. Dominion Coal Co., N.S.
1-200 K.W. Lethbridge
1-100 K.W. Northern Ontario Light & Power Co.
2- 70 K.W. Winnipeg Technical Schools
1- 70 K.W. Canada Motor Co., Winnipeg
1- 50 K.W. Medicine Hat

Siemens Company of Canada, Limited

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Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

FOR SALE

AT LOW PRICES

The following second-hand machinery and equipment:

A Steam Plant, composed of one 80 h.p. boiler, 61 in. x 14 ft., with 90 three-inch flues, together with all necessary mountings.
One 65 h.p. New Peerless Leonard Ball High Speed Engine, together with feed and exhaust pipes, almost good as new.
One Open Heater.
One Power Driven Duplex Boiler Feed Pump.
One 1-inch Injector.
One Electric Damper Regulator.
One Flue Blower, with steam hose.
One 54 ft. x 30 in. Iron Smoke Stack Chimney Cap, Guy Wires, Etc.

The whole of the above plant may be bought in one purchase, at a bargain, f.o.b. Norwich.

Electric Equipment

One 50 light, C.G.E. Co., type H. Transformer, with 2,200 and 1,100 volt primary, 220 or 110 volt secondary, 60 cycles.
Two 14 light and two 70 light C. G. E. Co. type F Transformers, 1040 volt primary, 104 volt secondary, 125 cycle.
One 1/8 h.p., 104 volt, 125 cycle, single phase, Emerson Motor.
One Portable Volt Meter.

All the following Meters are calibrated for 125 cycles at 100 to 110 volts, some of which may be re-calibrated for 60 cycles. All guaranteed to work satisfactorily.

Four 5 amp. Scheeffer watt hour.
One 10 amp. Scheeffer watt hour.
One 20 amp. Scheeffer watt hour.
Nine 5 amp. Westinghouse, types B C and Old.
Ten 5 amp. Peterborough.
Four 5 amp. Canadian General Electric High Torque.
Ten 5 amp. Western or Showalter.
Four 10 amp. Gutman.
One 50 amp. Gutman.

Apply to H. WEBSTER,
Norwich, Ont.
17

FOR SALE

Lights			Speed
2	450	Gen. Elec. type C. form T, direct-connected to Curtis form A non-condensing turbine, 100 lbs. pressure, 25 kw., 125 volt.	3600
2	450	Gen. Elec., 6-pole, form L, 25 kw., direct-connected to Westinghouse vertical gasoline engines	350
1	540	Gen. Elec., 6-pole, form F, comp., 30 kw. direct-connected to 11 x 8 in. Gen. Elec. vertical marine type engine, 125 volt	305
1	1300	Northern, MP, 75 kw., comp., direct-connected to Racine vertical cross comp. engine, 125 volt	275
1	1300	Westinghouse, 6-pole, comp., 75 kw., direct-connected to 14 x 14 Ames auto, center-crank horizontal engine, 125 volt	275

Send for our "Monthly Bargain Sheet" showing complete list of machines on hand with net prices. Every machine sold is completely overhauled and fully tested at our works before shipment, and is sent out practically "as good as new."

We Buy, Sell, Rent, Exchange and Repair.

GREGORY ELECTRIC CO.
CHICAGO, ILLINOIS

Established 1893.
1601 S. Lincoln Street. 14-t.

Agent required for high-class electric light fittings (French and Dutch styles). Apply, Box 852, Electrical News, Toronto.

Good Plant for Sale—New modern machine shop, fully equipped; twenty cent natural gas for power. Cheap lease and labor. Address W. D. Swayze, Dunnville, Ont., Canada. 17

For Sale

For Sale.—72 K.W. Generator with Exciter, Switchboards and Transformers. For particulars address W. Mitchell, Port Stanley. 17

Car Ventilating Systems

The Cooke System of Mechanical Car Ventilation. Specifications and estimates furnished. Manufactured in Canada under Canadian Patent 128070. Vacuum Car Ventilating Co., 561 W. Monroe Street, Chicago, Ill. e.o.i.

Engine and Generator For Sale

Owing to the Town of Stayner having secured a supply of power from the Hydro-Electric Power Commission of Ontario this equipment will not be needed after Sept. 1st. 1913.

1 100 H.P. 2 cylinder vertical Fairbanks-Morse Gas Engine, complete with oiling system, 5 years old.
1 Fairbanks-Morse Gas producer, complete for above.
1 30 K.W. 1,000 volt, 133 cycle single phase Royal Electric Generator, complete with exciter.
1 set of line shafting, complete with pulleys, clutches and belts,
1 marble panel switchboard with control equipment for generator and exciter.
1 Bulldozer Power Pump.
1 Duplex Plunger Pump.
1 Water Motor.

JOSEPH KNOX,
Stayner, Ontario.

CITY OF REGINA, SASK.

TENDERS

Sealed tenders, registered and clearly marked on the outside of the envelope "Tender for Power House Equipment," and addressed to the City Commissioners at Regina, Sask., will be received up until noon of October 1st, 1913, for the supply of:—

Coal bunkers, ash hoppers, coal and ash conveyors and crushers.

Price to be on equipment erected on foundation built by the City of Regina according to contractors' requirements.

A marked cheque for 5 per cent. of the amount of Lid, and made payable to the City Treasurer, City of Regina, must accompany each tender.

Specifications may be obtained from E. W. Bull, Superintendent of Light and Power, Regina, Sask.

The City Commissioners reserve the right to reject any or all tenders.

17-18

Situations Wanted

Wanted by Electrician position as Power House Operator. Experienced in line work and meter reading. Best of references. Address Box 856, Electrical News, Toronto, Ont. 17

Electrical Engineer, single, age 28, desires change. Seven years construction and maintenance work, Generators, Switchboards, Transmission lines, etc. Box 821, Electrical News, Toronto, Ont. 13-14

Young married man as switchboard operator in large power plant desires change, either power station or sub-station. Familiar with a.c. and d.c. apparatus. Eastern Ontario preferred. Address Box 857, Electrical News, Toronto. 17

Electrical Draughtsman wanted by large Canadian power company, Niagara Falls locality. Preferably to be experienced in design of high tension and low tension switch gears. Apply Box 861, Electrical News, Toronto. 7

Position Wanted—Engineer, electrical and mechanical, age 26, with extensive workshop experience and University training, desires suitable engagement; more particularly on the sales staff. References. Box 851, Electrical News, Toronto, Ont. 16-17

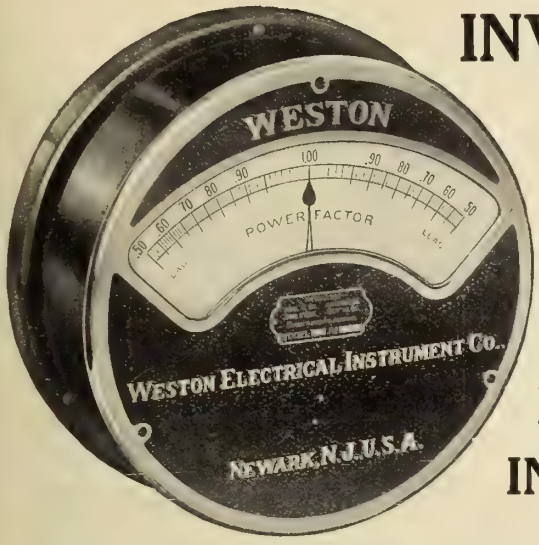
Electrical and Mechanical Engineer, age 34, married, desires responsible position, any location, 17 years experience, power house and general contracting, accustomed to estimating for and carrying out complete plants. Address Box 859, Electrical News, Toronto. 17

Electrician with three years experience managing water power plant, and good technical training, wants situation with electrical concern. Can furnish good references. State particulars in regard to size of present plant and possibilities of development, also salary and terms of contract. Address Box 870, Electrical News, Toronto. 17-18

Engineer, age 29, with good commercial training, requires position in office or elsewhere, where he will have plenty of work and prospects of advancement. Practical and technical training and experience in electrical and mechanical engineering (A.M.I.E.E.). Good correspondent, organizer, salesman and advertisement manager. Low salary until ability is proved. Box 501, G.P.O., Toronto. 17

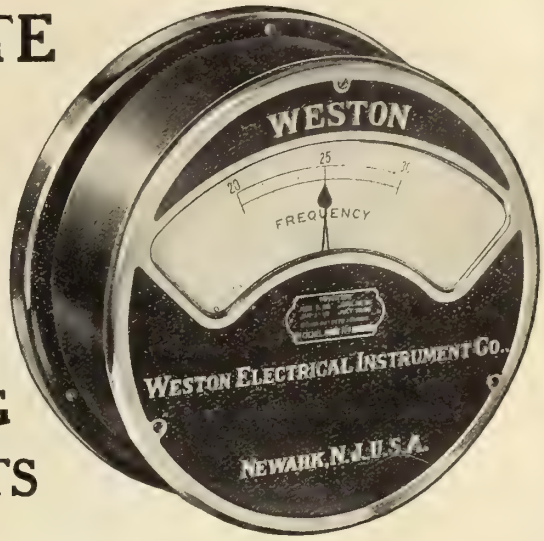
Manager (M.I.E.E., Fellow A.I.E.E.) desires situation. Technical and commercial engineer, 17 years in electrical field. Member of several technical societies. Has built and operated electric light and power, electric railway, hydraulic properties. Well posted upon utility commission investigations and municipal work. Expert in high tension, long distance transmission and management of hydro-electric properties and operation of properties that require reorganization and development. Address Box 863, Electrical News, Toronto. 17-18





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We invite full inquiry into the merits of **Weston Power Factor Meters** and **Frequency Meters** and also **Wattmeters, Synchroscopes, Ammeters and Voltmeters** for Switchboard service on alternating current circuits. Send for catalogs and advise us the kind of instruments in which you are interested, whether for alternating or direct current service.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto

Weston Electrical Instrument Company,

Main Office and Works
NEWARK, N. J.

New York, 114 Liberty Street.
Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
Detroit, 618 Union Trust Bldg.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Toronto, 76 Bay Street.
Winnipeg, Montreal, Calgary, Vancouver — Northern Electric & Mfg. Co.
London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. George
Berlin, Genest St. 5, Schoeneberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Building, Harrison St.



Power Cables

Manufactured by

British Insulated & Helsby Cables, Limited

PAID-UP CAPITAL, $8,500,000.00

HEAD OFFICE—PRESCOT, ENG. Works at PRESCOT, HELSBY and LIVERPOOL

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

WRITE FOR ILLUSTRATED CATALOGUE

SOLE CANADIAN REPRESENTATIVES:

Canadian British Insulated Co.

LIMITED

MONTREAL, QUE.

ELECTRICAL REPAIRS

The Electrical Engineering Co. of Toronto

130 Wellington Street West

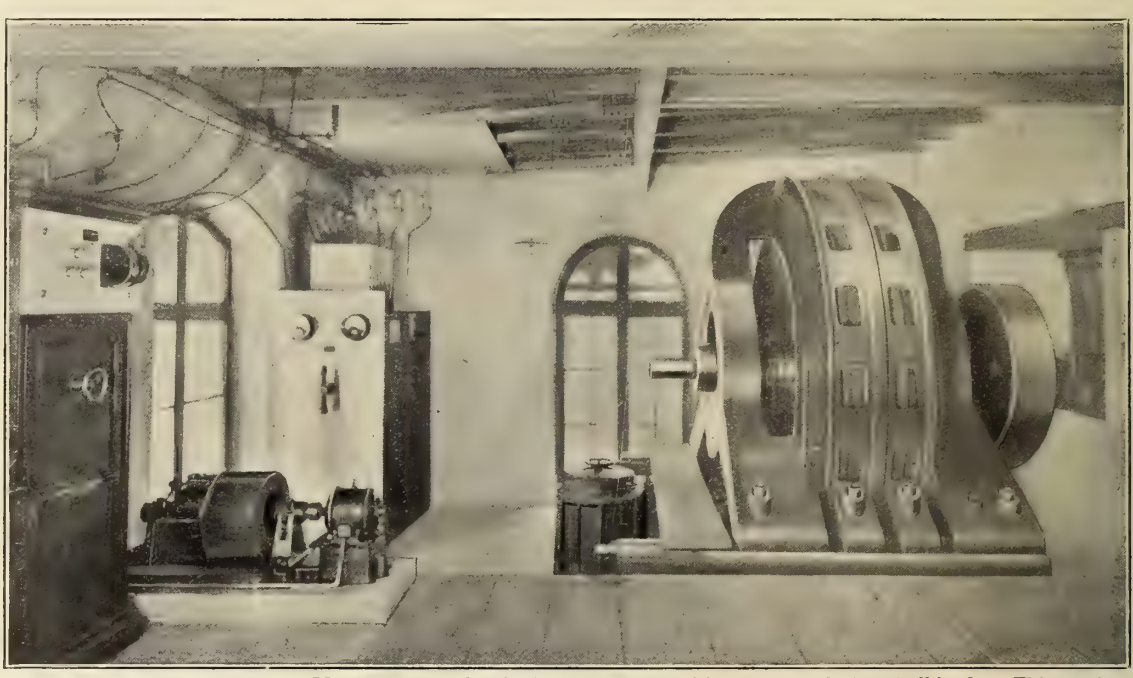
Manufacturer of special transformers and repairs of all types of electrical equipments.
Expert repair men at short notice day or night.

Our Motto—RAPID - RELIABLE - REPAIRS

Phones:—Day Adelaide 3183 Night College 2235

THE BROWN BOVERI PHASE COMPENSATOR

Improves the Power Factor of Induction Motors to 100%



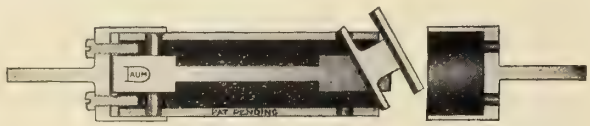
The 400 BHP, 160 RPM. Induction Motor, on the right of this cut, operates with 100% power factor at all loads. This result is brought about by the 1 H. P. motor phase compensator shown in the left hand corner.

Your Power Factor Trouble may be one we can remedy. Mail particulars of your requirements to:

THE CANADIAN CROCKER-WHEELER CO., LTD.

MANUFACTURERS AND ELECTRICAL ENGINEERS

Head Office and Works: St. Catharines, Ont. District Offices: Montreal, Que. Toronto, Ont. Vancouver, B. C.



Daum Refillable Cartridge Fuse Shells

In assembling this fuse, you simply take inner metal piece, which has two prongs, insert one on angle in one opening in fibre tube and move to one side in other openiug opposite; bend fuse-element over, slip cap over end, drop screws in each side of blade and fuse is assembled ready for use; and when once installed, becomes a permanent part of your equipment; note the flexibility of the fuse shells. Can be used for any capacity; from 3 to 30 amperes; 31 to 60 amperes; 61 to 100 amperes; etc.

The fuse element can be purchased most anywhere or from us.

Sole Mauufacturers

A. F. DAUM COMPANY, PITTSBURGH, PA.

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

The
Lachute Shuttle Co.
Limited
Lachute Mills, Que.

Manufacturers of

CROSS ARMS made from straight grained Douglas Fir, Long Leaf Yellow Pine and Red or Norway Pine.

The largest manufacturer of Cross Arms in the East.

INSULATOR TOP PINS made from Birch, Elm, Locust and Oak.

BRACKETS made from Birch and Oak.

POLE STEPS made from Oak.

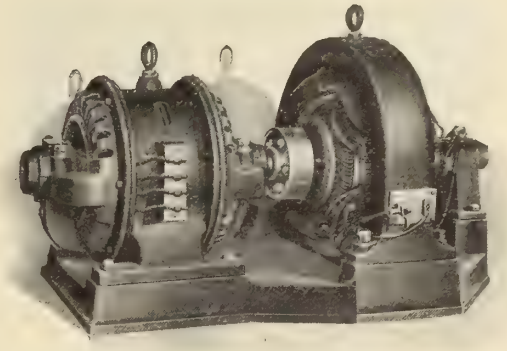
STRAIN PINS made from Second growth Hickory.

SPECIAL PINS for HIGH VOLTAGE TRANSMISSION made from Locust and Oak, all kinds and sizes.

All products boiled in Parafine and Stearine or Creosoted if wanted.

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HAMILTON



Make
Motors for all Circuits, Dynamos for Power and Light and Electroplating.

Repairs executed neatly and promptly.
Write Us.



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
Second, because it is the only renewable fuse that is uniformly rated.
Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

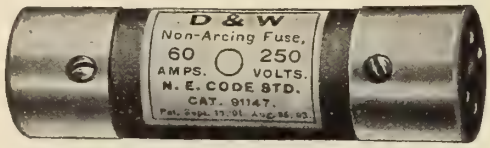
Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

Economy Fuse & Mfg. Co. of Canada, Limited
Herald Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.

The Sign of A Good Fuse



To ensure perfection in design, quality in material and efficiency in operation buy "D & W" Fuses.

They are the pioneers of enclosed fuses and are the result of careful research and long experience.

"D & W" fuses have many decided advantages over other makes.

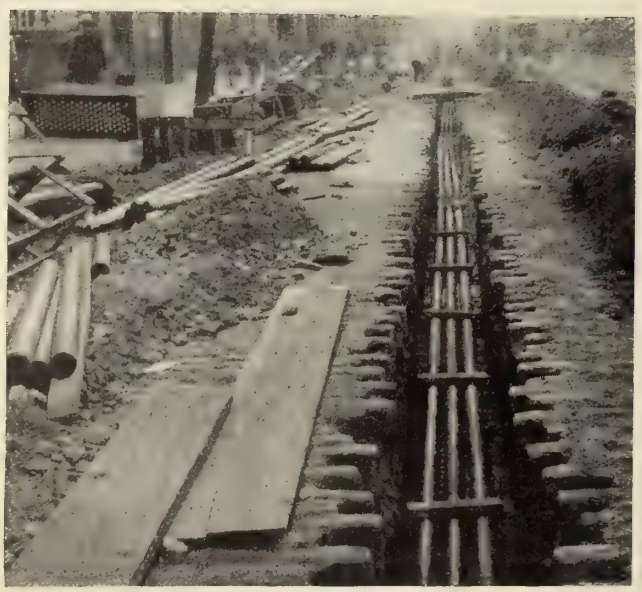
Other "D & W" specialties are fully described in our new illustrated catalog which shou'd be in the hands of every user of fuses. Send for Cat. No. 15 E to-day.

D & W FUSE CO., Providence R. I.

Canadian Representatives

THE Northern Electric AND MANUFACTURING CO. LIMITED

Montreal Halifax Toronto
Winnipeg Regina Calgary
Edmonton Vancouver



Manitoba Gov. Installation at Winnipeg.

Long Lengths 7 ft. Thick Walls 3/8 inch. Long Joints 5/8 inch,

We will absolutely guarantee a puncture strength of 50,000 volts and an absorption of moisture for 100 hours of less than ¼ of 1%.

Comparison of above figures with other types of Fiber Conduit will show the superiority of our product.

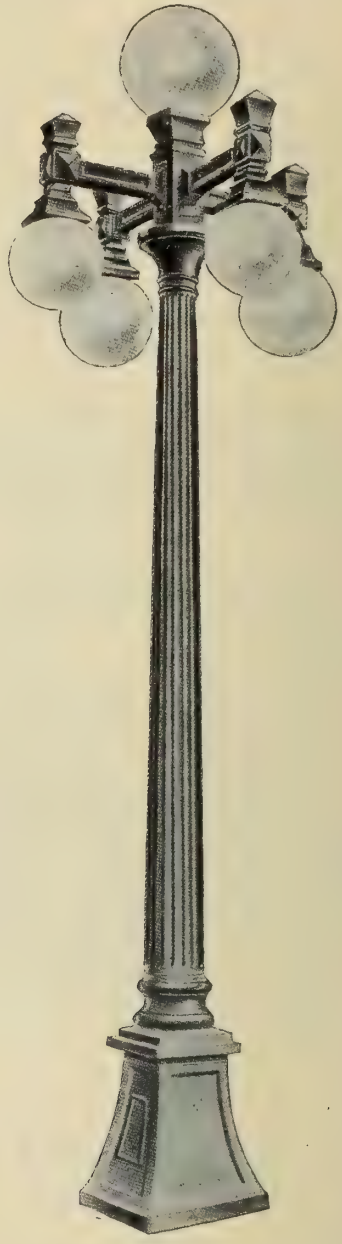
American Conduit Co.

East Chicago, Ind., U. S. A. 140 Nassau St., N. Y. City

Distributors for Canada:

The Northern Electric & Mfg. Company, Limited, Montreal, Halifax, Toronto, Winnipeg, Regina, Calgary, Edmonton, Vancouver.

MORRIS Street Lighting Poles



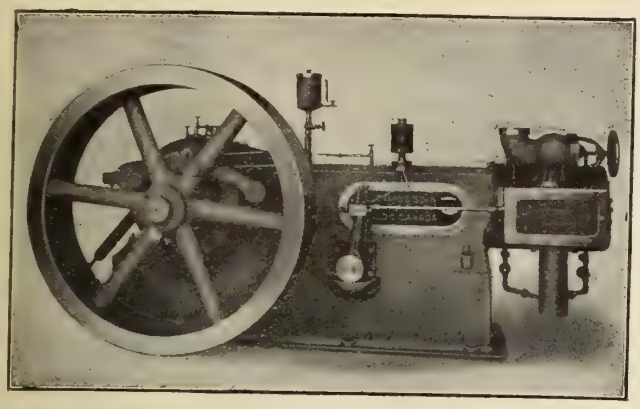
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American Agencies Ltd.
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Engines of All Types
for
Electrical Service

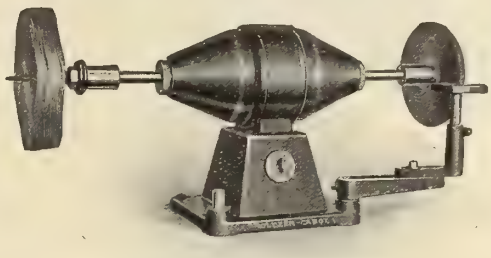
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E. Leonard & Sons, London, Can.

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Holtzer - Cabot

Buffing Motors
Grinding Motors



Note

1. The snap switch for starting
2. The gasketed joints
3. The shaft supported by long bearings
4. The adjustable tool rest
5. The lots of room around the wheels

For Direct, Single or Polyphase.

The Holtzer-Cabot Electric Co.
Boston - Chicago



Agents for
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Telephones, Bells, Annunciators, Etc.

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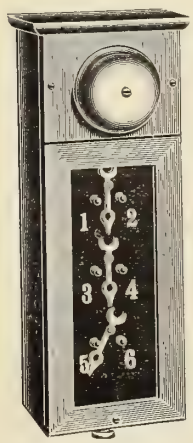
BRITISH COLUMBIA.—Cope & Son Ltd.
Water Street, Vancouver

ALBERTA.—General Supplies Ltd,
122 Eleventh Ave. W., Calgary

QUEBEC.—Stocks kept by:-Dawson & Co., Ltd., Montreal. Mechanics Supply Co., St. Paul, Quebec.

NOVA SCOTIA.—Stocks kept by:—John Starr, Son & Co. Ltd., Halifax.

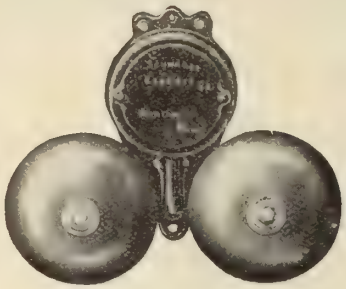
NEW BRUNSWICK.—Stocks kept by:—St. John Railway, Dock Street.



No. C6178 Needle-drop Annunciator

English Manufacture

STERLING TELEPHONES
BRITISH MADE



We Have a Bell For Every Purpose

There can be only **one best** and that is the **Schwarze. No. 12 Common Magneto Extension** for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire **is all active**. Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and **very much louder**, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof. Write for catalogue. **All resistances,**

Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents

Do you want Specialists to figure on your

Transmission Lines
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Power Plants Heating
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Then ask

Dietrich LIMITED

300 Read Bldg. Montreal

ASK US about
Efficient Lighting

for your streets, factory, warehouse or yard

A. H. WINTER JOYNER, Ltd.

76 Bay Street, Toronto

"Consult A Specialist"

Special Notice

The name of the

Central Electric & School Supply Co., Limited

has been changed to the

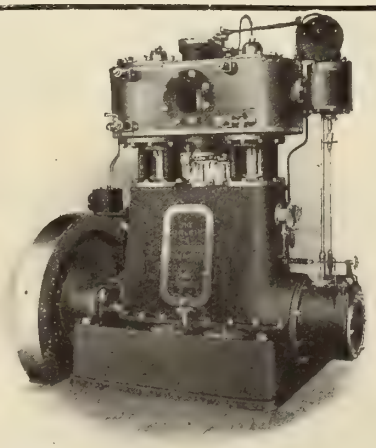
Central Electric Supply Co., Limited

We have disposed of our stock of School Supplies and are going to use our entire building for electrical supplies and apparatus in order that we may carry a larger and more complete stock and give our customers better service.

Write for catalogue No. 3

Central Electric Supply Co., Limited

36 Adelaide St. West, Toronto
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Vertical, Forced Lubrication

Quick Revolution Engines

With Combined Throttle and Expansion Governor

These engines are giving excellent service wherever installed. They are built for service and are economical in consumption of steam and require little or no attention while running. The materials used are in accordance with British Admiralty Specifications. Ask for detailed information.

All Engines are Tested under Steam before leaving our works

THE GOLDIE & McCULLOCH COMPANY, LIMITED

Head Office and Works: Galt, Ontario, Canada

Branches:—Toronto Montreal Winnipeg Vancouver and St. John, N. B.

¶ Here are three sisters of the Pilabrasgo Family that are not only remarkably efficient but **remarkable sellers!**

Delica White, Lily Tint and Ecru Tint Lighting Glassware

¶ They're perfect in quality and beauty, and they give you the necessary variety of color—white, light green and ecru.

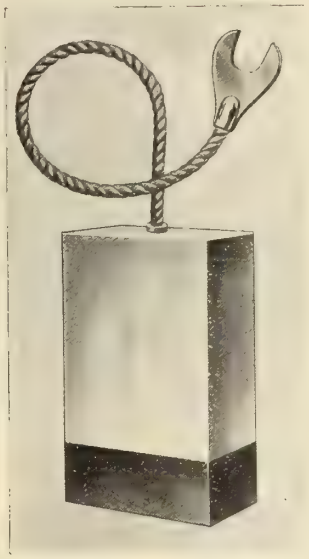
¶ When we tell you that our factory is **pushed to its capacity** to keep ahead of orders on these wares, we are telling only the **literal truth**. You'll find them very strong. Write for catalogue.

The Pittsburgh Lamp, Brass and Glass Co., of Canada, Limited

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London, Ontario

PILABRASGO

R. E. DAVIS
Representative



CARBON BRUSHES

For over twenty years we have been marketing carbon brushes and are able to guarantee a perfect product.

Becker brushes have great strength, perfect lubrication and will not split or break.

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Send us your inquiries for any style of Gauze—Carbon or Magneto Brushes.

Becker Brothers 561 W. Washington St. CHICAGO, ILLINOIS.



No 115

BANNER TRADE MARK

Artistic and Attractive Designs in

Lighting Fixtures

"Banner" Electric Fixtures embody all the popular and most up-to-date designs together with many of our exclusive creations.

Write us for an estimate on your next job.

We specialize on making fixtures from original drawings on short notice.

"Banner" Fixtures

MADE BY



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Ontario Lantern & Lamp Co., Limited,

HAMILTON, CANADA.



HOPE

Tapes and Webbings

for

Electrical Work

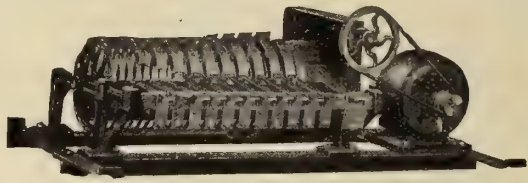
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Hope Webbing Company

Providence, R.I.

RECO FLASHERS

FOR ELECTRIC SIGNS AND DISPLAYS



Made in every style.



ADJUSTABLE -- SIMPLE -- DURABLE

COLORED LAMP HOODS

GET OUR LATEST BULLETINS

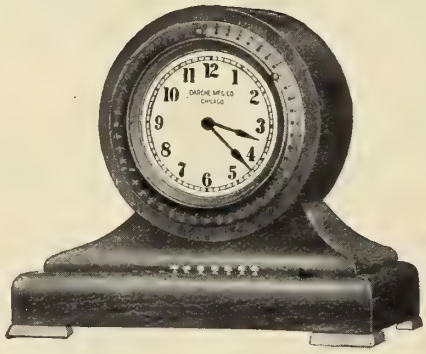
Reynolds Electric Flasher Mfg. Co.

Largest Manufacturers of Flashers in the World.
Also Manufacturers of Billboard Reflectors, Time Clocks, Transformers, Window Displays, etc.

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Something New

Darche Reminder Clock



By merely placing a plug at any desired time, clock will cause an alarm.

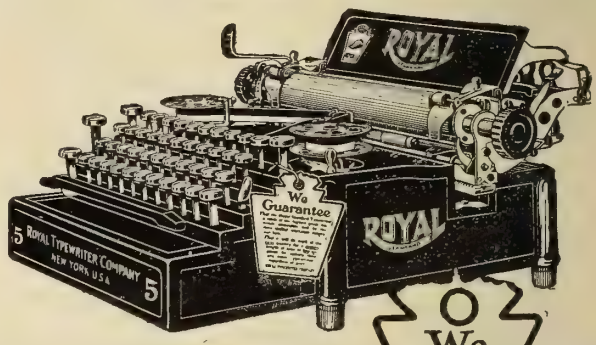
Operated by dry battery.

Ready for use.

AGENTS WANTED

Darche Mfg. Co. - Chicago

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We Guarantee

That the Royal Standard Typewriter is made of the highest grade materials obtainable and by the most skillful workmen money can hire;

That it will do work of the best quality for a greater length of time at less expense for upkeep than any other typewriter, regardless of price.

ROYAL TYPEWRITER COMPANY

$95.00

The ONLY machine for the Electrical Trade.

Special keys for electrical expressions furnished FREE.

Attractive terms for the electrical Fraternity.

ROYAL TYPEWRITER SALES CO., Ltd.

Alfred Landau, Pres.

96 W. King St. Toronto

Yager's Soldering Fluxes

4 Forms—1 Result—The Perfect Joint

Efficiency is the word. Let us co-operate with you to increase the efficiency of your service. Use Yager's Fluxes in any of the four convenient forms — Salts—Stick—Paste — Fluid, to produce joints which will not fail you at the critical moment. No acid in any of them. They make the perfect electrical joint.

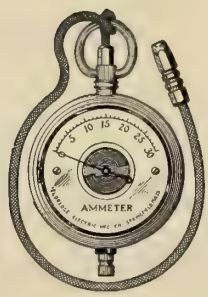
Write now for sample and discount.



ALEX. R. BENSON COMPANY

HUDSON, N. Y.

Pocket Battery Ammeters



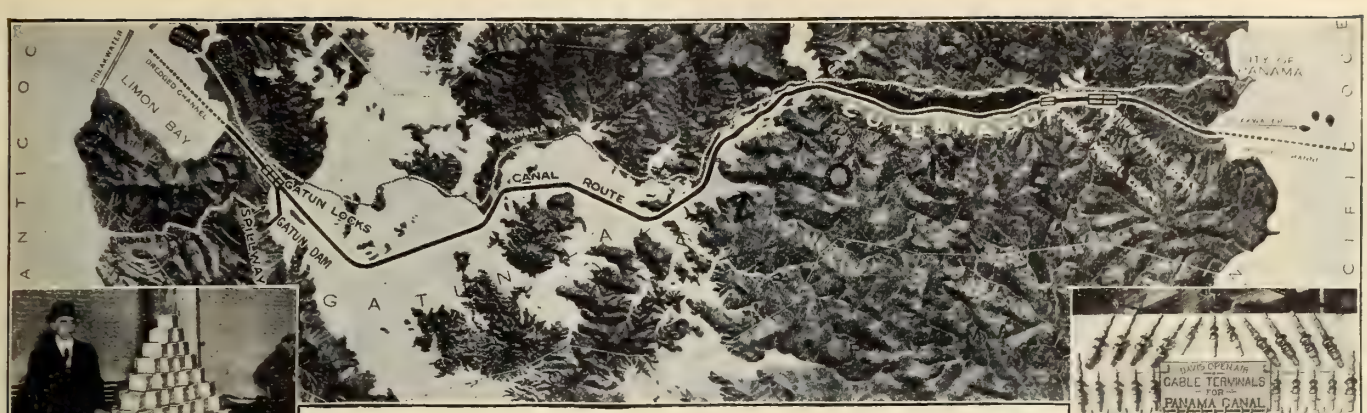
Voltmeters and Volt-ammeters, Small Switch-board Instruments, Lamp Testers.

Accurate, Durable.

Eldridge Electric Mfg. Co.

97 Post Office Square

SPRINGFIELD, MASS., U.S.A.





Above illustrations show one type of terminal supplied and partial shipment of same.

Where Quality Wins

Climatic conditions at Panama require that electric cables be given the best possible protection against moisture. That is **one** reason why

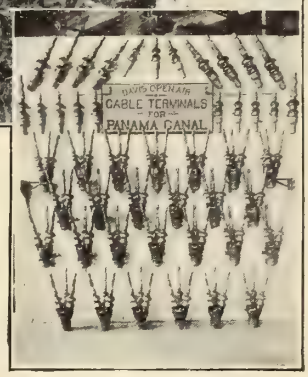
"STANDARD" Cable Terminals

were bought in large quantities by the U. S. Government for use in the electrification of the Canal. If you want the best protection for your cables, let us explain why "Standard" Terminals, with their patented features, are best.

Write our nearest office

Standard Underground Cable Co., of Canada, Limited,

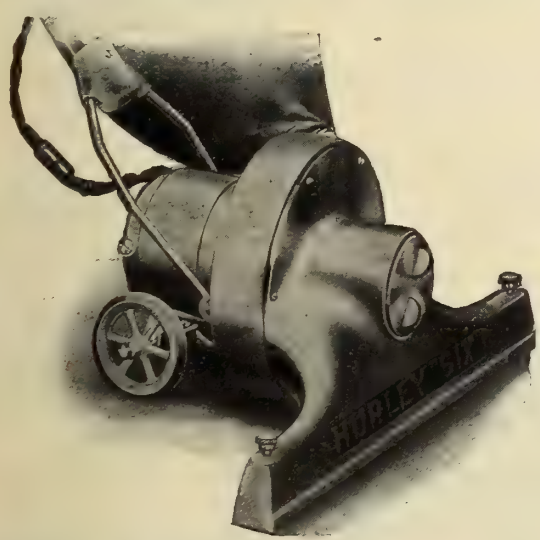
Montreal, Que. Hamilton, Ont. Winnipeg, Man.
Boston, Mass. Seattle, Wash.





This and above illustration show types of terminals supplied.

Hurley Electric Vacuum Cleaners



The Last Word in Electric Cleaners

MADE OF ALUMINIUM—NICELY FINISHED.

Absolutely Guaranteed, electrically and mechanically.

The "Hurley" is the only cleaner on the market that will pick up strings, hair, lint, ravellings, etc. This is an exclusive feature, and one that will be hailed with delight by thousands of women who are familiar with the old type machines.

Made in two sizes "Hurley Six" and "Hurley Four." Each size has a complete outfit of accessories.

Mainer Electric Company, Limited

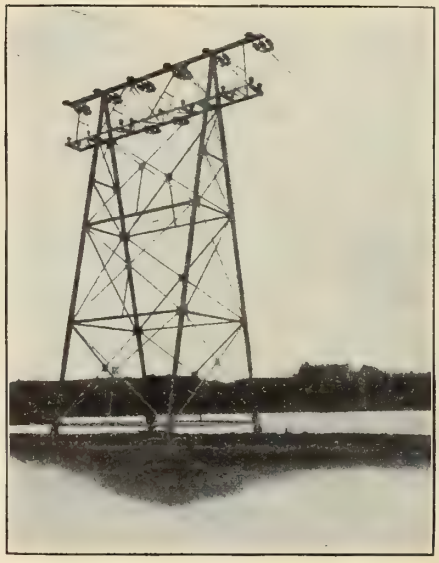
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The largest Electrical Supply House in the West.



"GOOD POLES QUICK"
for our Canadian customers means
British Columbia Cedar Poles
shipped from some one of our 14 pole yards in Canada. Our Canadian Stocks are by far the largest and most complete.
May we quote you?
The Lindsley Brothers Company
Spokane—Regina—Chicago
Construction Supply Co., Toronto, Representatives

The Steel Company of Canada, Limited
Manufacturers of
COPPER WIRES AND CABLES



Consult us regarding—
Bare Copper Wire
Copper Trolley Wire
Copper Cable
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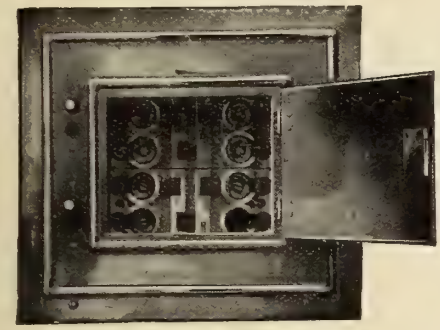
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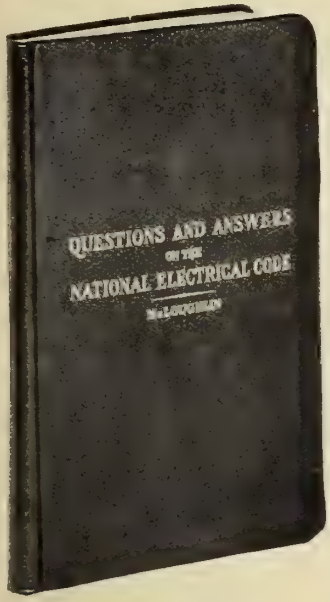
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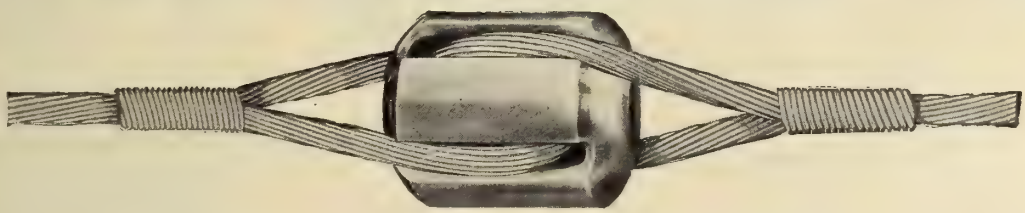
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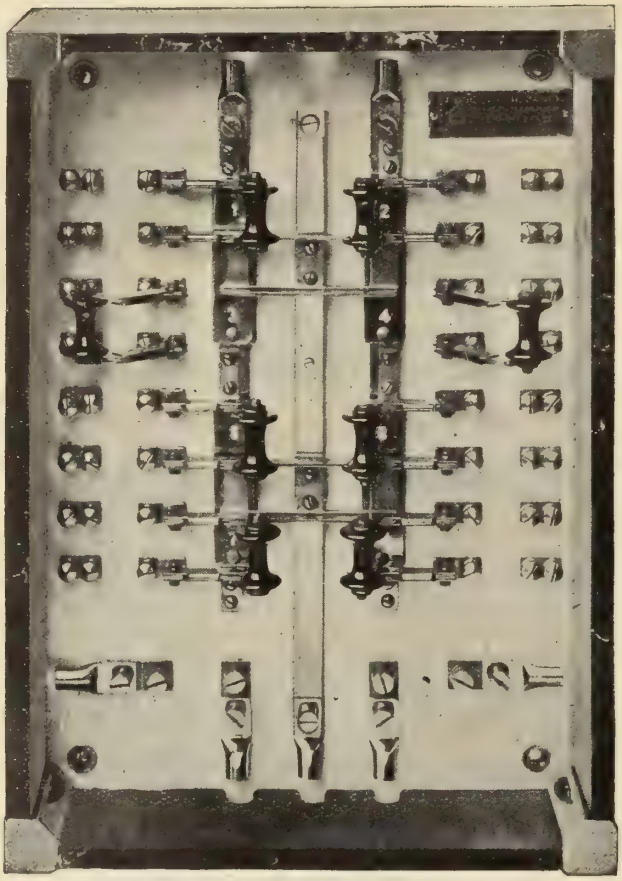
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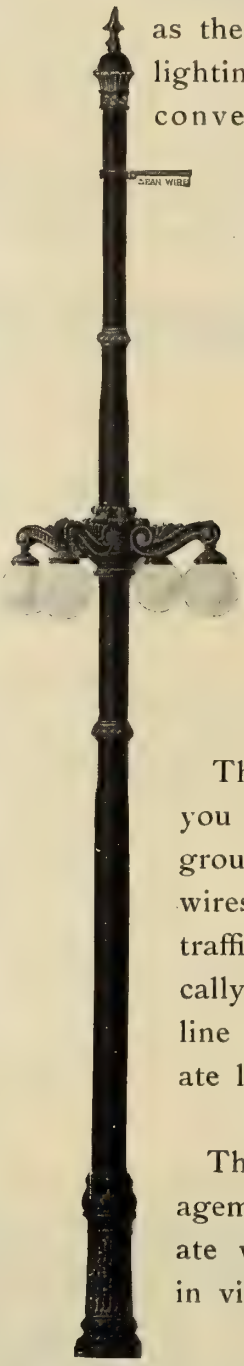
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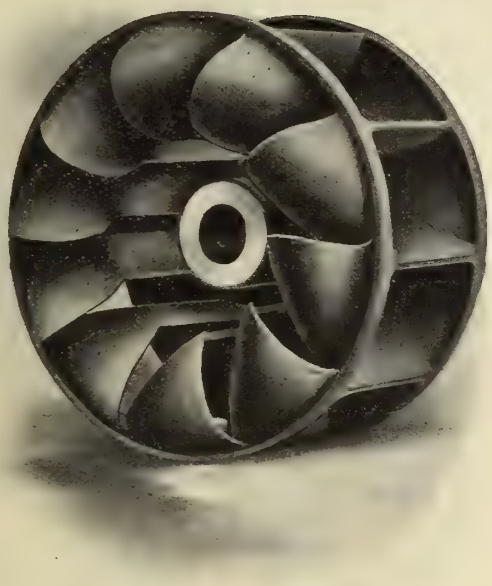
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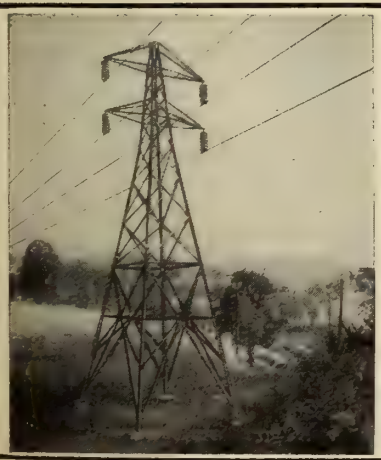
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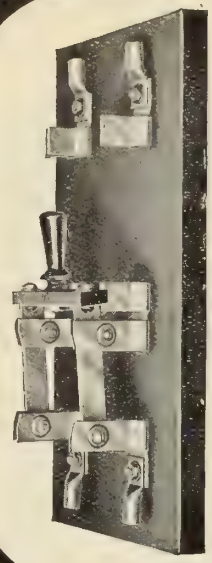
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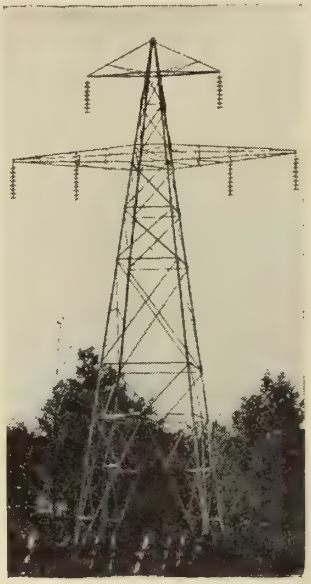
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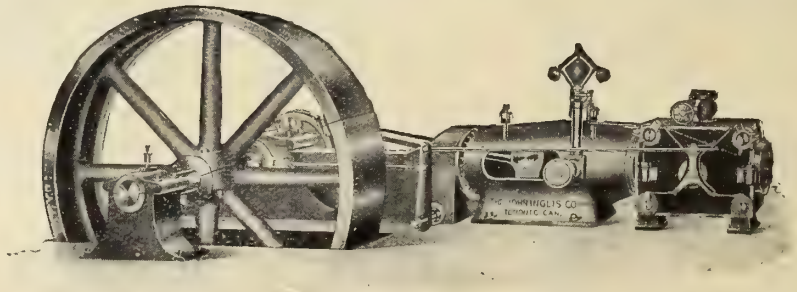
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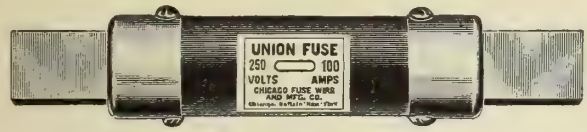
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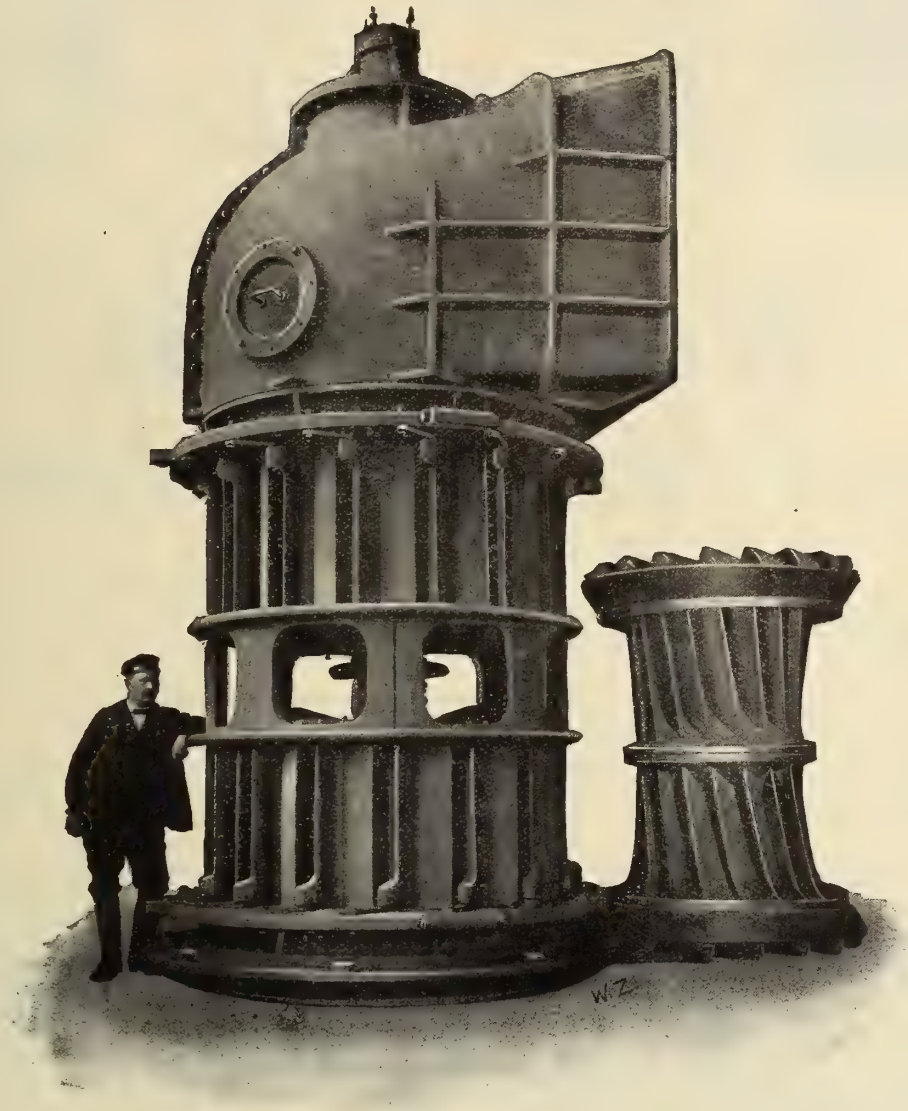
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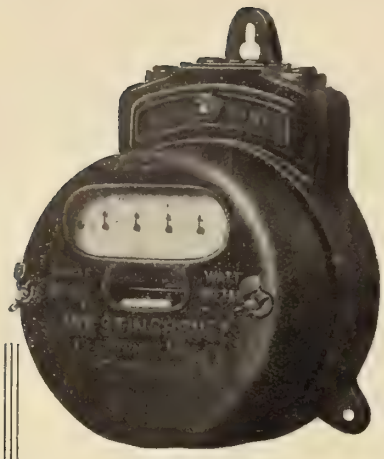
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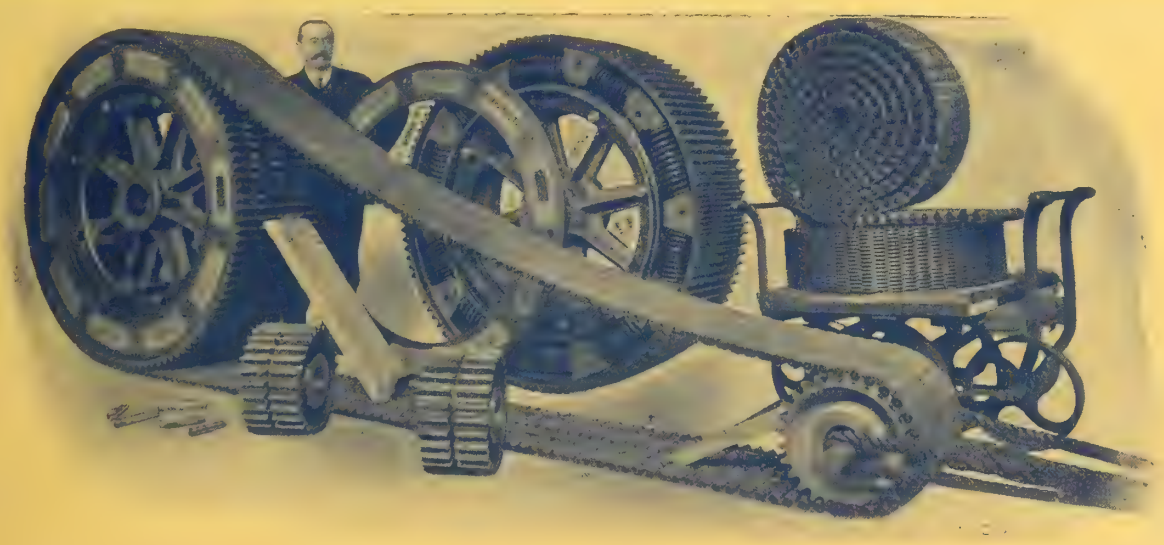
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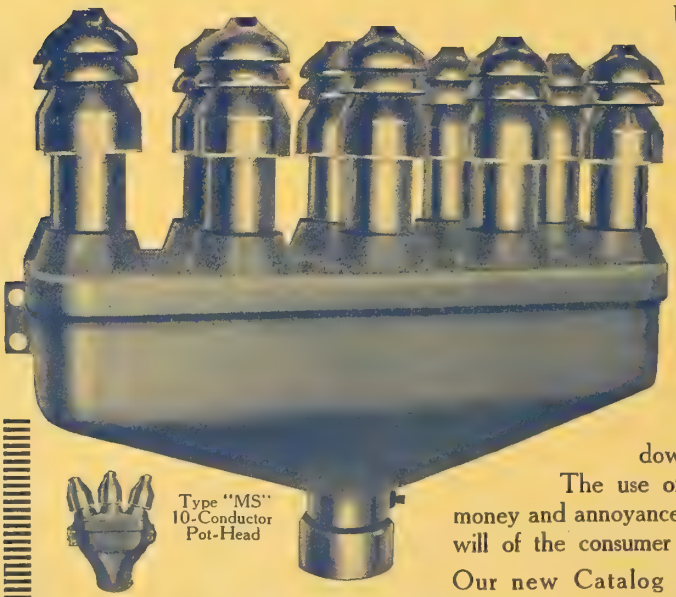
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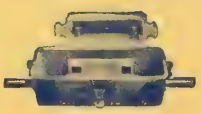
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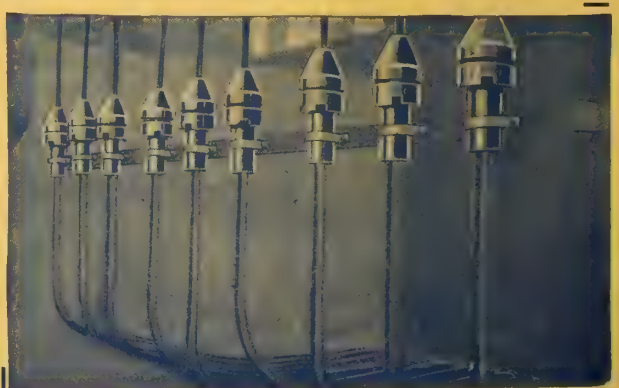
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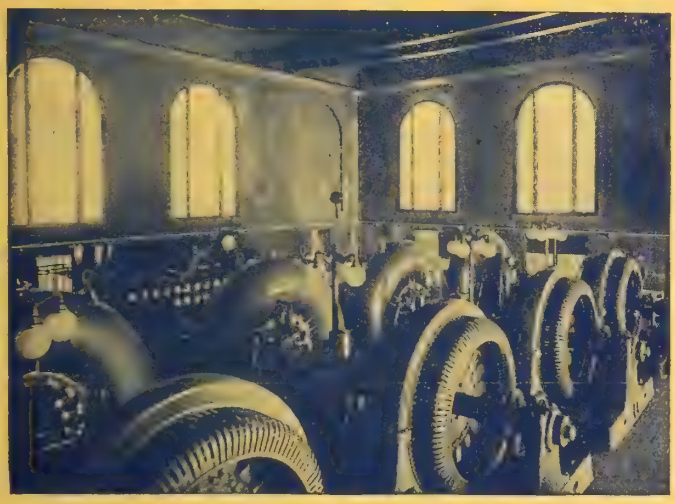
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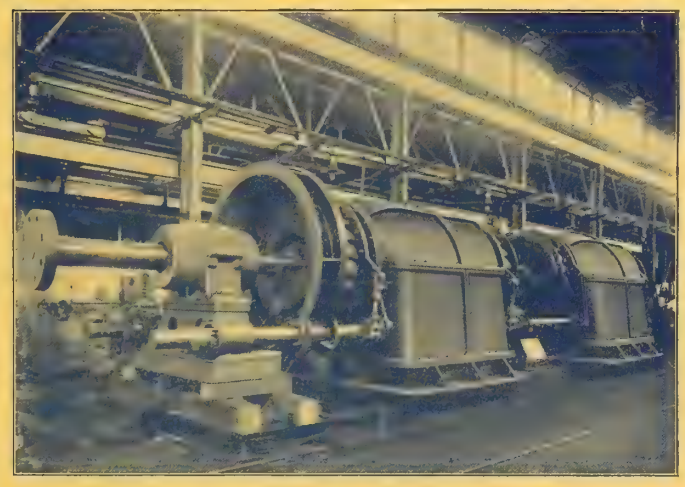
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Telephone, Telegraph, Lighting, Power and Street Railway Wires, Cables and Equipment.





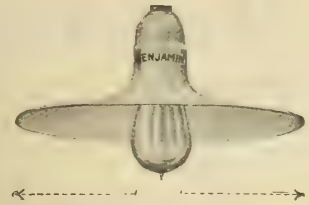
Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

Branches: HALIFAX TORONTO WINNIPEG VANCOUVER



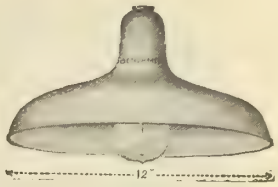




Flat Reflector Socket
Cat. No. 5402



Outdoor Streetlite
Cat. No. T74



Bowl Reflector Socket
Cat. No. 5421

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Reflectors and Fixtures

for your

Fall Lighting Equipment

A Fixture or Reflector for Every Requirement

Benjamin Fixtures and Reflectors are carefully designed to give proper and maximum illumination.

Send us blue prints or sketch of your factory.

Let our engineering department offer its recommendations.

Catalog C-21 is full of various styles and types. Send for it today.

"BUY BENJAMIN"

Made in Canada
FROM YOUR JOBBER

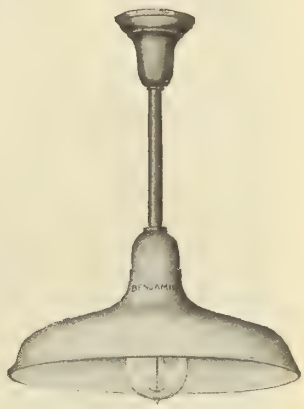
Benjamin Electric Mfg. Co.

of Canada, Limited

11-17 Charlotte St. Toronto



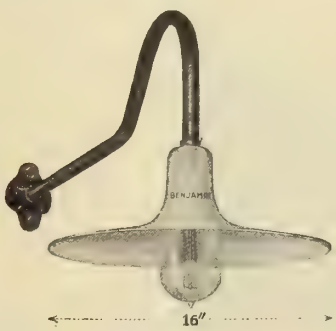
Office Fixture
Cat. No. 1004



Office Fixture
Cat. No. 6046



Adjustable Reflector
Cat. No. 6162



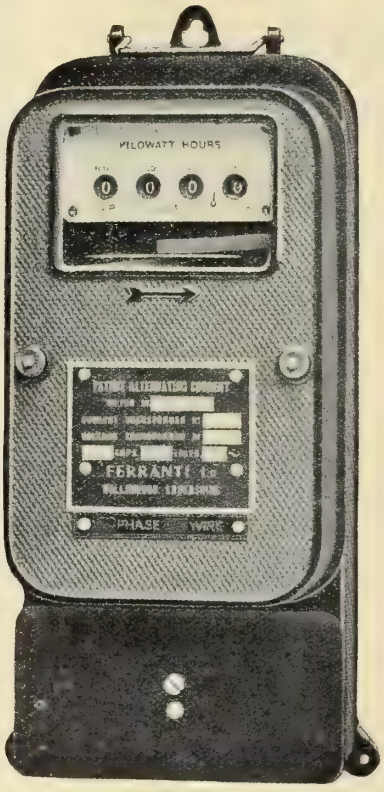
Platform Bracket
Cat. No. 5412



Deep Bowl Reflector Socket
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SINGLE PHASE METER.



POLYPHASE METER.

Ferranti Meters

Single Phase and Polyphase

Type "C"

Represent the *highest* grade of mechanical and electrical construction.

The electrical design is the result of years of research and wide experience, while the mechanical arrangement is designed in accordance with the demands of Electric Light Men who use meters.

They are supplied with the Terminals at the Top or at the Bottom as desired.

They are supplied with Clock or Cycle Dials.

For Accuracy they cannot be beaten. They catch every passing watt, and add it faithfully to the reading on the plain legible dial. It matters not whether the wave has a hump on its back, or is sway-back, or whether the current is trotting along in arm with the voltage or whether it is lagging behind like the fat wife of a spry husband.

There are thousands of them in use in Canada today, as well as in nearly every country in the world.

Every meter is carefully inspected before being shipped.

We carry large stocks in Toronto and Winnipeg, and can always make prompt shipments.

Ferranti Transformers

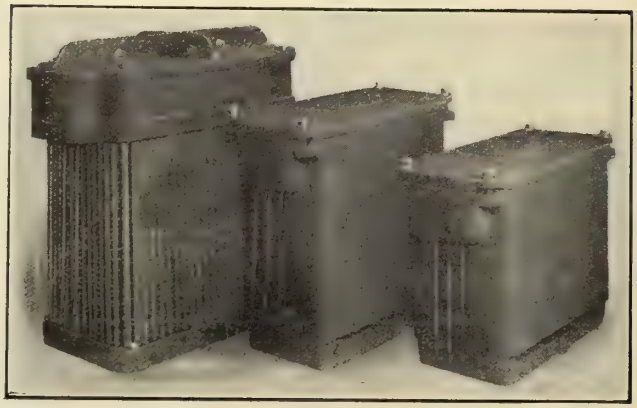
highly efficient at all times.

Of all transformers the three phase type is the most economical to operate and most saving in construction costs.

The efficiency of Ferranti Three Phase Transformers is apparent because of the great reduction in energy loss. The transmission line thus equipped is invariably a profitable one.

All coils are wound by the latest approved methods, thereby reducing losses to a minimum.

We also supply Switch Boards, Motor Panels and Instruments.



THREE PHASE POLE OR STATION TRANSFORMERS.

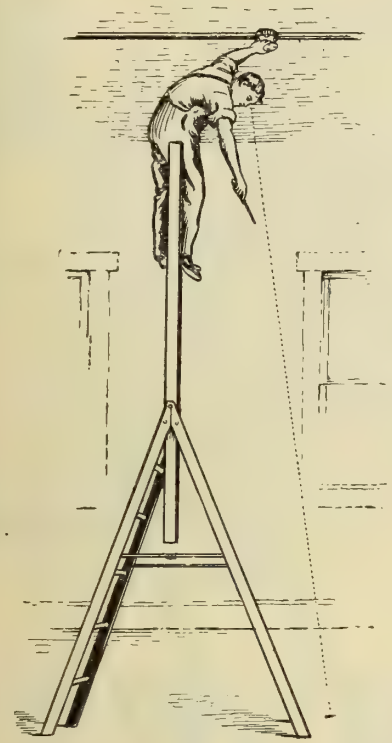
Write for further Particulars and let us make an estimate for you.

The Ferranti Electrical Co.

of Canada, Limited

90 Sherbourne St., TORONTO

56 Albert St., WINNIPEG

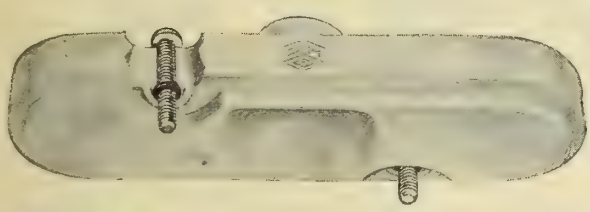


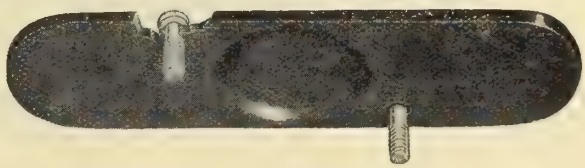
Couldn't Happen with a Condulet Cover

Screws That Can't Fall Out

Users of Condulets Lose No Time Picking Up Fastening Screws for Covers or Conduletto Fittings.

Brass Screws—the Proper Quantity, Size, Shape and Thread—are furnished with Condulet Covers and Conduletto Fittings, and are so secured in screw holes that they ***can't fall out.***







Screw for Porcelains

Screws for Porcelain Covers and Fittings are held in place by formed up fibre washers that engage the screw thread. Washer is put on after screw has been inserted in screw hole, and fits within cup made for it in the porcelain.

Screws for Metal Covers are necked just under the head, and screw holes in covers are tapped. When threading on screw has passed threading in hole, no shaking or knocks can make screw back out.



Screw for Metal Covers

NOTICE—This company has discontinued furnishing cover and fitting fastening screws with Condulets. These screws are now furnished with Condulet Covers and Conduletto Fittings for Condulets.

Crouse-Hinds Co. of Canada, Limited

Main Office and Works:

Toronto, Ontario, Canada



"ARROW E"

Switches and Pole Sockets are made in this new, perfectly equipped plant under ideal manufacturing conditions. They are **Made Right and Guaranteed.**

Our NEW CATALOG shows complete line of Wiring Devices

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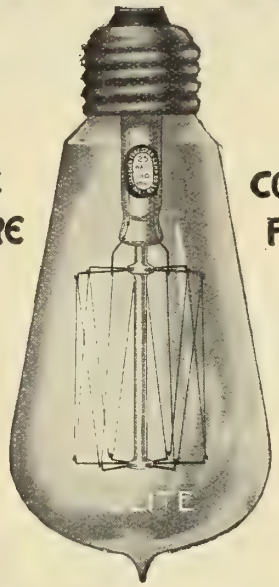
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"NULITE"

TUNGSTEN LAMP

GENUINE DRAWN WIRE

CONTINUOUS FILAMENT



The Lamp With a Record

—Prices Reduced— —Quality Maintained—

Dealers supplied with their own selling literature as follows; Domestic Circular Letters, Commercial Circular Letters, Factory Circular Letters, General Folders.

Our Lamps and proposition are the best you can get.

Now is the time to make arrangements for your season's stock.

"NULITE" A Canadian Product

manufactured by

THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.
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"GALVADUCT" Shops

GALVADUCT
AND
LORICATED

These high class conduits have been used in many of the largest public, office and industrial buildings in Canada.

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated.

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A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

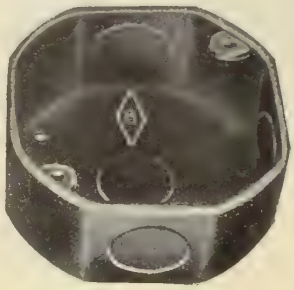
If your jobber cannot supply you—write us.

Conduits Company Limited.

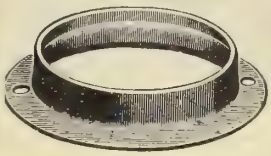
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Made in Canada

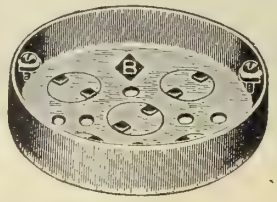
Iron Conduit—Conduit Boxes—Pipe Fittings and Accessories



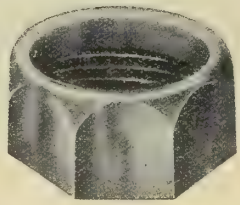
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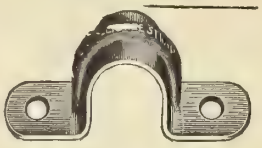
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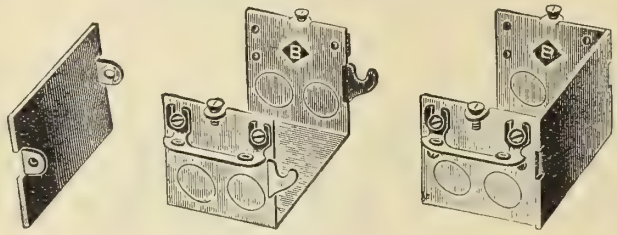


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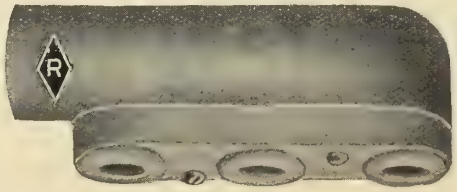


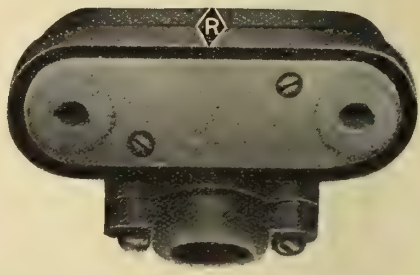
Type C 3″ deep—C C -2″ deep
side comes off and does away with carrying two gangs

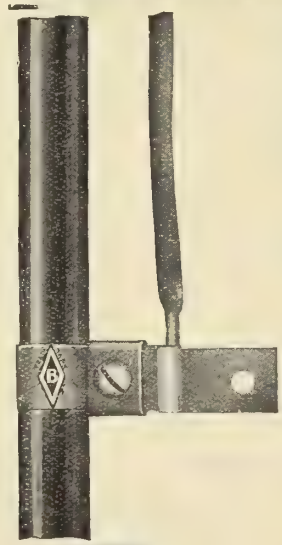


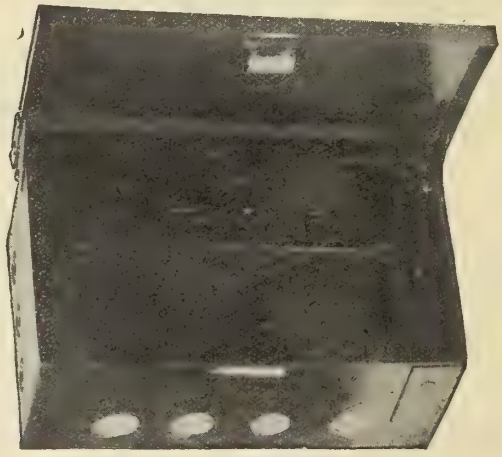
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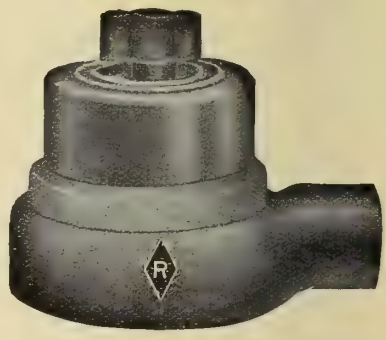


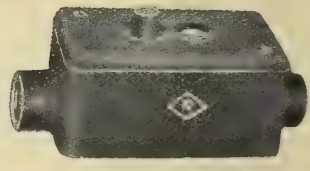




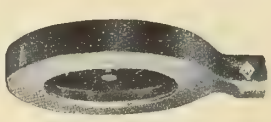


Steel Cutout Boxes



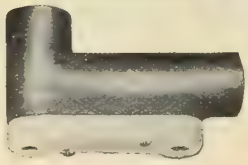






Type P





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Munderloh & Company, Limited
Montreal, Que.

John Starr Son & Co., Limited
Halifax, N.S.

St. John Railway Company
St. John, N.B.

CONSOLIDATED TUNGSTOLIERS

Something New in Fixtures

CONSOLIDATED TUNGSTOLIERS

Get Catalogue 180a

The Tungstolier Company of Canada Limited

212 King Street West, TORONTO

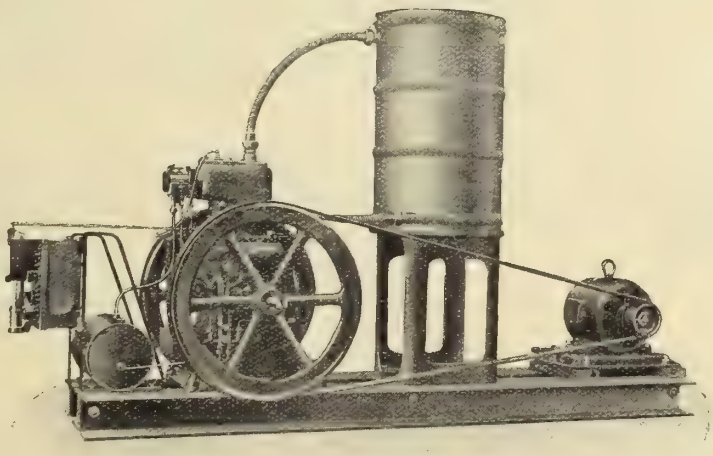
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The LISTER-BRUSTON

AUTOMATIC ELECTRIC LIGHTING PLANT

is the best plant on the market for

Country Houses
Hotels
Clubs
Churches
Factories
Small Towns
Villages



is the easiest and cheapest plant to install and wins you the confidence of your customer.

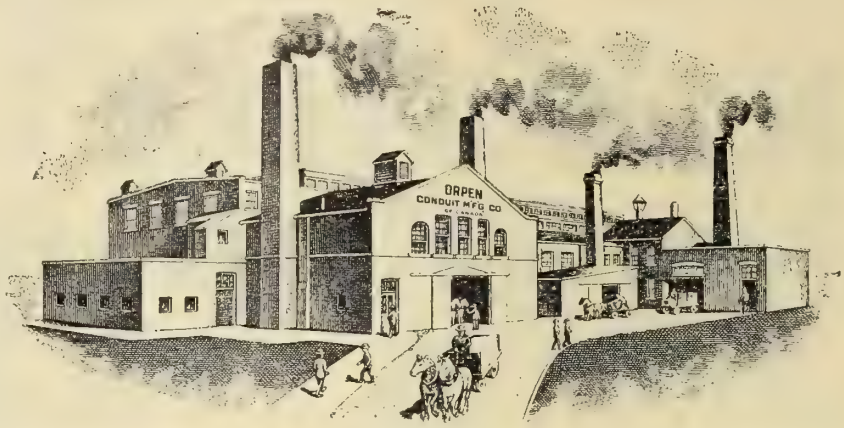
Agents Wanted

Starts itself, stops itself and requires practically no attention.

R. A. LISTER & COMPANY, LIMITED

Winnipeg — 58-60 STEWART ST. / 190 KING ST. W. — **TORONTO** — **St. John, N. B.**

The home of EXCELADUCT and ORPENITE CONDUITS



Queen and Dufferin Streets TORONTO

"EXCELADUCT"

"Exceladuct" is a high grade of galvanized conduit made of easy-bending spellarized steel tubing, doubly protected against rust by copper plating and zinc coating. Every length is made up with clean threads and smooth enameled interior, allowing easy and rapid fishing.

INTERIOR CONDUITS

ORPEN CONDUIT MANUFACTURING CO of CANADA
MANUFACTURERS OF XCELADUCT ORPENITE CONDUITS
HEAD OFFICE TORONTO ONTARIO

Let us send Prices and Samples

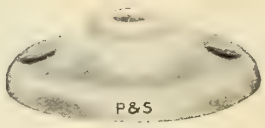
"ORPENITE CONDUITS"

"Orpenite" Enameled Conduit is made of easy-bending spellarized steel tubing which is protected against rust and proof against all temperature conditions by coatings of specially prepared enamel. Each length presents clean threads and a smooth interior permitting of easy and rapid fishing.

THE ORPEN CONDUIT MANUFACTURING COMPANY of CANADA

MONTREAL TORONTO

New Outlet Box Rosette



P & S 1172
for 3 inch Boxes



P & S 1173
for 4 inch Boxes

Made of pure white glazed porcelain

Used as a box cover and fuseless rosette, combined.

Each carton contains the necessary screws to fasten to outlet box.

EXPENSIVE? NO.

Free samples and quotations gladly supplied on request.

Pass & Seymour, Inc.

Main Office and Works:
Solvay, New York, U. S. A.
San Francisco, Rialto Building

Sold by all Jobbers. Carried in stock by:

HALIFAX—John Starr & Son Co., Ltd.
ST. JOHN—St. John Railway Co.
QUEBEC—Mechanics Supply Co.
MONTREAL—Dawson & Co., Ltd.
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WINNIPEG—Mainer Electric Co.
CALGARY—General Supplies, Ltd.
VANCOUVER—Cope & Son.

CAPITAL 100,000 DOLLARS

R. H. MAINER VICE., PRES. & GEN., MGR

THE MAINER ELECTRIC COMPANY LIMITED

Wholesale Traders in

ELECTRICAL SUPPLIES AND APPARATUS
ELECTRICAL SPECIALTIES
AUTOMOBILE AND LAUNCH ACCESSORIES
BRANCH OFFICES - SASKATOON AND EDMONTON

CABLE ADRESS "MAINER"
PHONE GARRY 3600-3601
P.O. BOX 1166

61-63 ALBERT STREET
WINNIPEG
CANADA

Mr. Dealer & Contractor,
Western Canada.

Dear Sir:-

August 1913 marked the close of our first year in the Electrical Supply Business in Western Canada. And a remarkably successful year it has been despite a good deal of talk regarding financial stringencies, etc.

Since we opened our doors last year, our growth has been phenomenal. We have twice as many employees, our Warehouse floor space has been doubled, and our volume of business has increased more than six times.

While we feel that much of this success has been due to our own efforts, we do not wish to take all the credit to ourselves, but to extend our sincere thanks to our many friends throughout the West, who have contributed so largely to our prosperity, by giving us at all times their unqualified support.

We have tried always to give a first class service to our customers, through our different Departments, and the fact that we have had very few complaints, leads us to believe that in this respect we have also been successful.

The year just beginning promises to be, for us, more prosperous than the one just passed. May we hope for a continuance of your good will and support, so that our continued prosperity may be assured.

Again thanking you,

We remain,
Sincerely yours,
THE MAINER ELECTRIC CO. LTD.

R. H. Mainer

Manager.

MICA

KENT BROTHERS

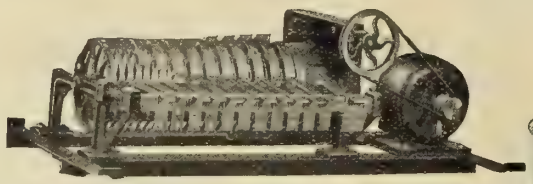
Kingston, Ont., Canada

Miners, Exporters and Dealers in Canadian Amber Mica.

Thumb Trimmed, Cut to Size, Splittings, Discs, Washers, Etc.

Write us for prices and let us figure on your requirements.

RECO FLASHERS FOR ELECTRIC SIGNS AND DISPLAYS



Made in every style.



ADJUSTABLE -- SIMPLE -- DURABLE

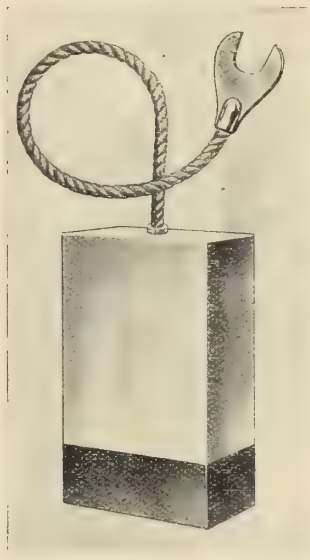
COLORED LAMP HOODS

GET OUR LATEST BULLETINS

Reynolds Electric Flasher Mfg. Co.

Largest Manufacturers of Flashers in the World.
Also Manufacturers of Billboard Reflectors, Time Clocks, Transformers, Window Displays, etc.

No. 1123 Broadway, **New York.** No. 617-631 W. Jackson Blvd., **CHICAGO**



Special Motor and Dynamo Brushes To Order

We are prepared to make with accuracy and promptness any special sizes in carbon brushes.

Our B.B. special carbon brush is of the highest class. It is so blended and tempered that it has an extremely long life and the lubrication is positive through the life of the brush.

Get our catalogue containing prices.

Send us your inquiries for any style of Gauze — Carbon or Magneto Brushes

Becker Brothers

561 W. Washington St., Chicago, Illinois

¶ Here are three sisters of the Pilabrasgo Family that are not only remarkably efficient but **remarkable sellers!**

Delica White, Lily Tint and Ecru Tint Lighting Glassware

¶ They're perfect in quality and beauty, and they give you the necessary variety of color—white, light green and ecru.

¶ When we tell you that our factory is **pushed to its capacity** to keep ahead of orders on these wares, we are telling only the **literal truth.** You'll find them very strong. Write for catalogue.

The Pittsburgh Lamp, Brass and Glass Co., of Canada, Limited

119 Wortley Rd.
London, Ontario

PILABRASGO

R. E. DAVIS
Representative

ELECTRICAL REPAIRS

The Electrical Engineering Co. of Toronto

130 Wellington Street West

Manufacturer of special transformers and repairs of all types of electrical equipments.
Expert repair men at short notice day or night.

Our Motto—RAPID - RELIABLE - REPAIRS

Phones:—Day Adelaide 3183 Night College 2235

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IT'S A NEW ONE

Our new catalogue on the

Holophane-D'Olier Metal Reflector Line

will tell you and acquaint you with the most complete line of Steel and Porcelain Enamel Reflectors made.

WRITE FOR IT

The Holophane Co., Ltd., Toronto, Can.

Monarch Electric Co., Ltd.

St. Lambert, P. Q.

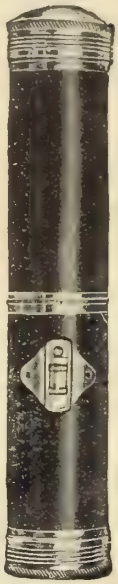
Phone Main 3988 Montreal Exchange **District Montreal**

A few of the Monarch Canadian Made Specialties manufactured in this, our own building, are:

Sockets—Rosettes—Attachment Plugs
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Oil Circuit Breakers
Switchboard Accessories
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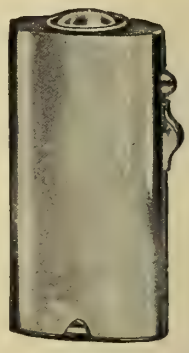


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This is a profitable line to carry. The popularity of portable Electric Lamps is increasing every day. Eveready Flashlights give satisfactory service under all conditions. They are equipped with the Eveready guaranteed Tungsten Battery and Mazda Bulb.





The complete stock carried at each of our branch houses insures prompt shipment on all orders.





You will be interested in our special dealers' proposition. Write our nearest house for information.

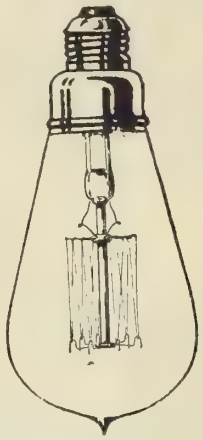
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Manufacturer of Telephone and Fire Alarm Apparatus and Distributor of Electrical Supplies for every possible need.

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AMERICAN BEAUTY
ELECTRIC HEATING DEVICES
Educate your customers to buy them by the box
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THE Northern-Electric
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When you want a lamp of quality, order the Ile Drawn Wire Tungsten Lamp.
Long Life; Less Current; More Light; Great Strength; Freedom from Bulb Blacking; Price Lowest for quality; Manufactured in New York.



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TRADE MARK

Is an unusually strong Tungsten Lamp with a Drawn wire continuous filament.

It will stand considerable hard usage, and may be burned at any angle.

Write us for prices

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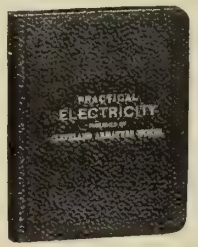
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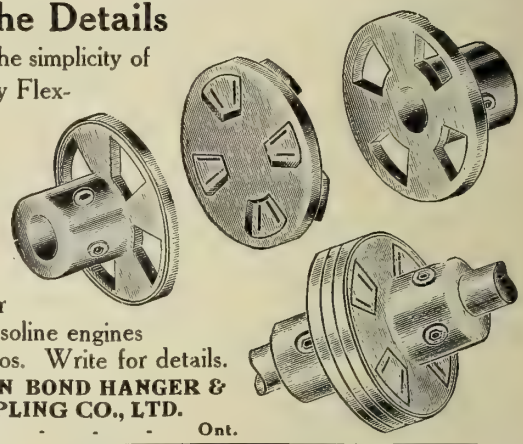


Every electrician should have a copy of this book. Price - $2.00 delivered

CLEVELAND ARMATURE WORKS, Cleveland, Ohio

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Note the simplicity of the Grundy Flexible Insulated Coupling. It's positive, silent, powerful. Just the thing for coupling gasoline engines and dynamos. Write for details.

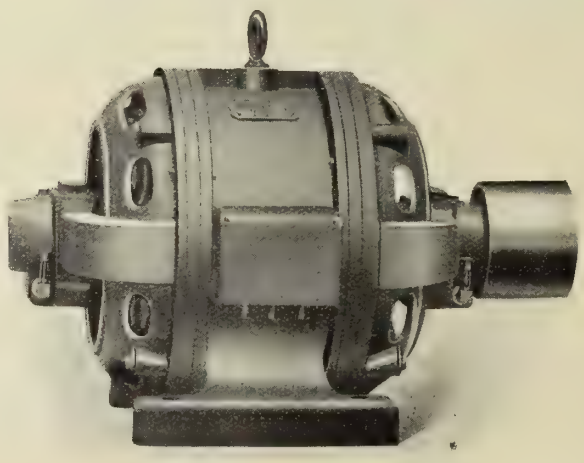


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"UNION" MOTORS

Stock carried at MONTREAL, TORONTO, WINNIPEG and VANCOUVER

High Efficiency
Great Overload Capacity
Ample Ventilation



Sound Mechanical Construction and Smooth Running

Pattern H.D. Squirrel Cage Motor

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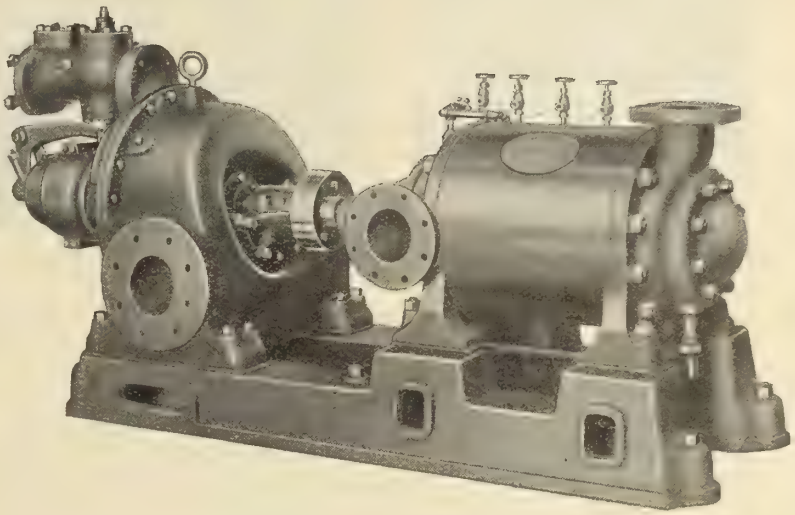
THE MAINER ELECTRIC CO., LTD., 61-3 Albert Street, WINNIPEG, MAN.

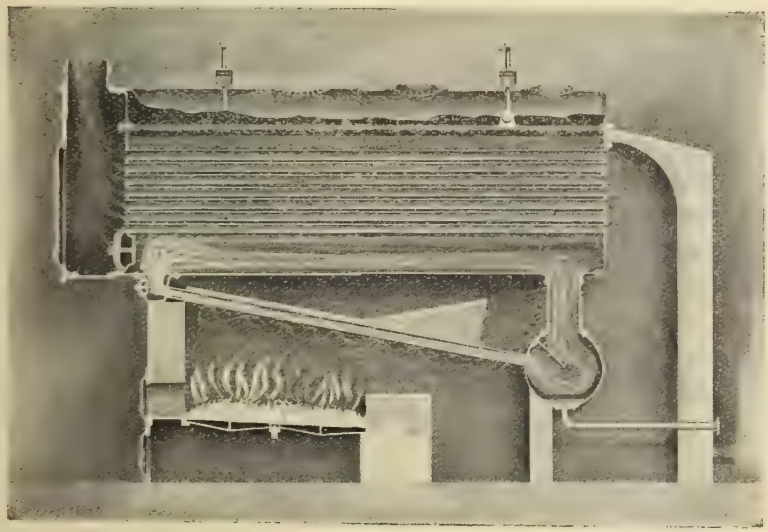
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One of our turbine pumps driven by a 50 H. P. Curtis steam turbine supplying 130,000 lbs. of water per hour at 225 lbs. pressure.





Barrow Boilers

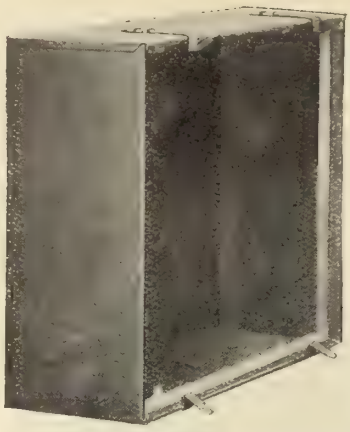
The Barrow Combination Boiler embodies the three essentials of good boiler design, i. e., abundant steam and water space, perfect circulation, perfect combustion.

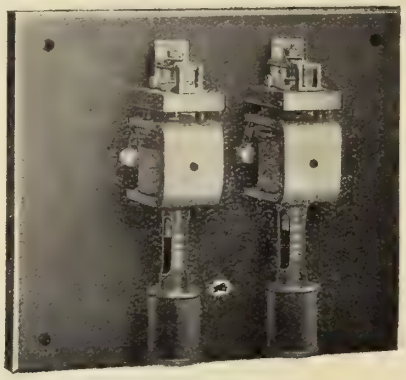
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MANUFACTURERS OF Air Compressors, Boilers, Cement MakingMachinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, SteamTurbines, Structural Steel, Transmission Machinery, Turbine Pumps, Water wheels.

This Overload Relay Cuts Out Fuse Bills and Speeds Up Production





Overload Relay Panel with Enclosing Cover Removed

It can be attached to any modern C.G.E. Compensator and can be adjusted to trip at any load which the motor will stand. It has a time limit adjustment which can be regulated according to the service. This relay eliminates the expense of fuses and in addition increases the production which it is possible to obtain from any motor-driven machine because in case of overload it can be reset immediately by the operator, without waiting for the electrician to replace fuses or otherwise adjust the starting device.

Other advantages of the modern C.G.E. Compensator are as follows:

1. The handle cannot be left in starting position.
1. The handle cannot be moved to running position without first going to the starting position.
3. The no voltage release opens the circuit in case of failure of voltage.
4. Switches are oil immersed, thus eliminating sparking and insuring long life of contacts.
5. Compound treatment of the coils makes them practically waterproof.

Many plants are replacing their old starters with modern C.G.E. industrial control.

Our nearest District Office will gladly furnish Prices and Full Particulars.

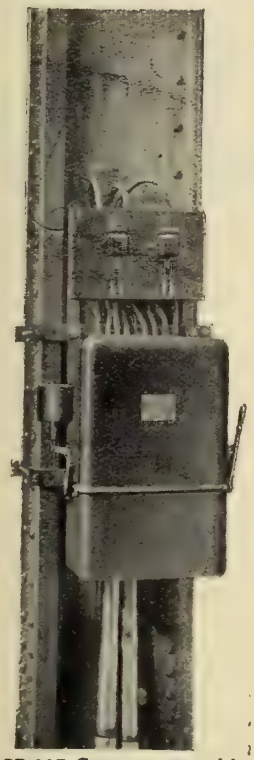
CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
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This Modern C-G-E Compensator

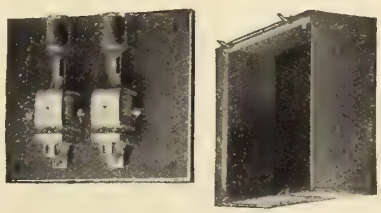


CR-117 Compensator with overload release, for controlling squirrel cage Induction motors

with overload relay attachment (above the compensator) does with fuses and consequent delays in production.

This feature together with the no-voltage release (at the left) and the superior design of the oil immersed electrical contacts, justify the removal of old starters on the basis of the decreased maintenance and increased production obtained with modern C-G-E equipment.

Our nearest district office will gladly furnish price and full particulars



Overload relay panel with enclosing cover removed

CANADIAN GENERAL ELECTRIC CO.

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Head Office: TORONTO

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Moloney Quality

FOR sixteen years we have been making only transformers. All our time, study and every part of our plant is devoted to the manufacture of high efficiency transformers.

All materials used in Moloney transformers are selected for their merits. Silicon steel as used by us is the best material known for transformer cores—we proved this after a hard test extending over a year and a half.

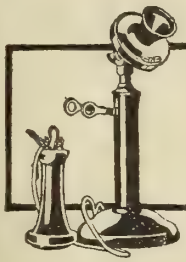
Our catalogue contains many useful hints for users of transformers, and also describes our product fully. A card will bring it.

Canadian Moloney Electric Co., Limited

WINDSOR, ONTARIO

825 Vancouver Block, Vancouver, B.C., Canada 901 New Electric Railway Chamber, Winnipeg, Man., Canada
501 C.P.R. Building, Toronto, Ont., Canada

Complete Stocks at **Windsor, Winnipeg, Vancouver**



SAFEGUARD
YOUR SERVICE

THERE are more than 500 telephone "troubles" in Jacksonville every day due to telephone receivers being left off the hook.

Your telephone is reported "Busy" or out of order when the receiver is left off the hook, no one can call you and you are likely to suffer serious inconvenience.

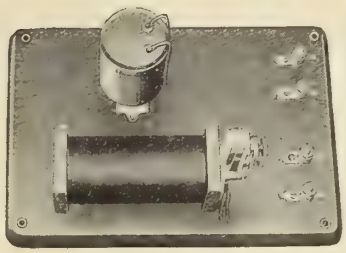
On duplex and party lines all telephones on the line are rendered useless when any one of the receivers is left off the hook.

When you receive a call for a person who answers at an extension telephone, see that your receiver is replaced as soon as the telephone is answered.

Watch your telephone, see that employees are careful to replace the receiver, your service will be improved and you will aid us to increase the efficiency of the service throughout Jacksonville.

May we have your co-operation?

SOUTHERN BELL TELEPHONE
AND TELEGRAPH COMPANY



Safeguard Your Service

BUY A HOWLER

Spare your subscribers and yourself delays due to receivers being off the hook

The Kellogg howler (illustration above) is one of our standard induction coils with interrupter and condenser mounted on a nicely finish, oak panel.

It can be screwed up on the wall or set horizontally on a table or on the switchboard.

It is connected to the line through cord and plug at the board. Simply insert the plug in the jack "of the offending party" and work the key. A good lively "howl" is the result. If desired the apparatus can be connected to the wire chief's desk and he can do the signalling without carrying through the board.

Settle this "receiver off the hook" annoyance with dispatch. Buy a howler.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

MAIN OFFICE AND FACTORY: CHICAGO

CANADIAN SALES OFFICES:
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HOUSTON & COMPANY, LIMITED, WINNIPEG, MAN.
B. C. HOLST & COMPANY, VANCOUVER B.C.

Moonstone Glass



4054—60 Watt



4052—40 Watt



4050—25 Watt



4056—100 Watt

The Sanitary Reflectors here shown were especially designed for Hospitals There is an entire absence of crevices thus preventing the collection of dust and germs. Another notable feature is that the reflectors can be easily cleaned without being removed from the fixtures. Moonstone Glass was given the preference over all other semi-translucent glasses by the lighting committee of the Toronto General Hospital, on account of its color and efficiency.



4058—150 Watt

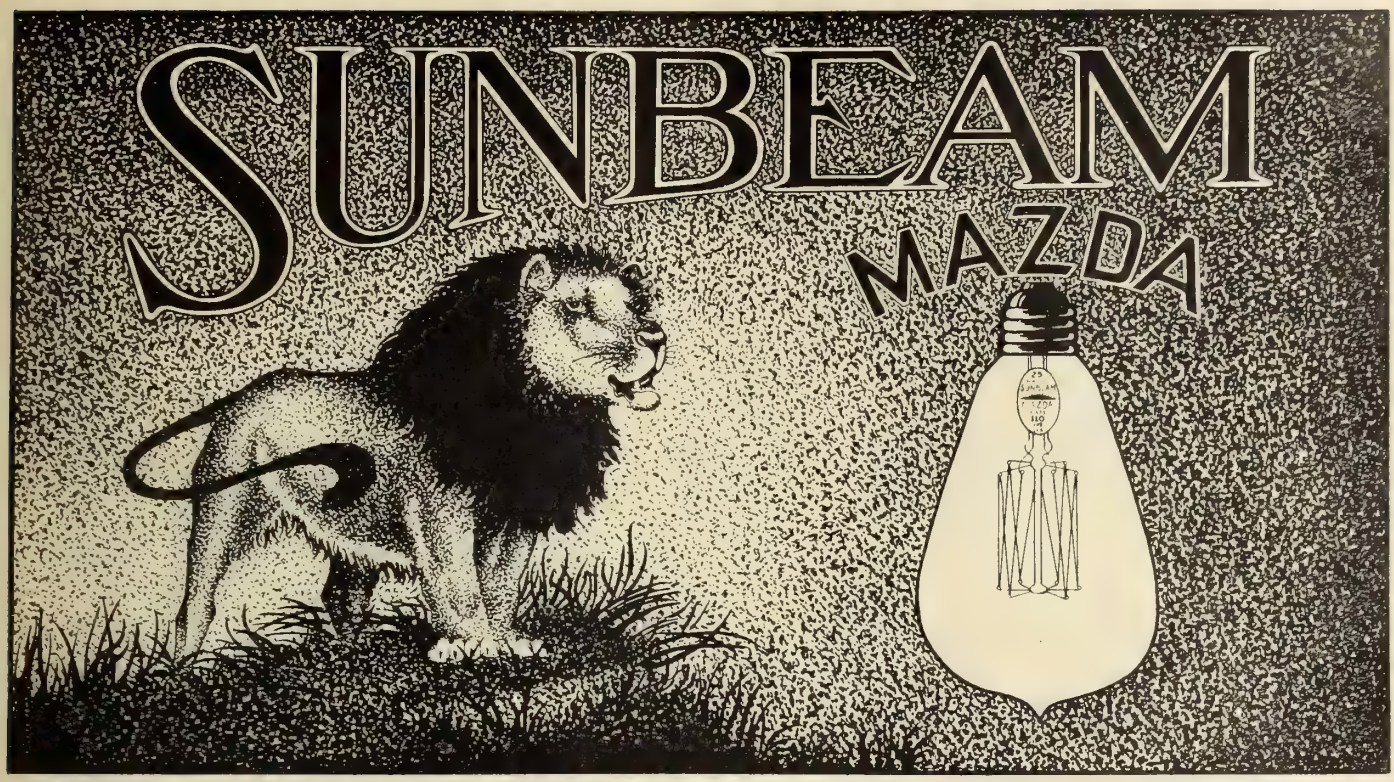


4060—250 Watt

The Jefferson Glass Company *Limited*

MADE IN CANADA

TORONTO CANADA



AS the lion is the symbol of strength and leader of all animals so is the

Sunbeam Mazda Lamp

the leader of all lamps and the ideal of strength in lamp construction.

The lamp makers who know how.

Your Jobber Can Supply You

Canadian Sunbeam Lamp Co., Limited

Main Office and Factory: TORONTO

BRANCH WAREHOUSES :

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Franklin Prismatic Reflectors

Tungsten Lighting

All Kinds of Illuminating Glassware
High Efficiency, Decorative, Indirect, Plain, Common

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SHOW ROOMS: NEW YORK CHICAGO SAN FRANCISCO

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entire issues of bonds on steam and electric railroad, gas, electric and hydro-electric properties.

N. W. HARRIS & CO.

Established 1882
Incorporated 1911

35 Federal Street, Boston, U.S.A.

Sparkless Commutation Demands

CERTAIN, DEFINITE BRUSH RESISTANCE

depending upon the design of the motor or generator. Further—

A Definite Degree of Abrasiveness Is Necessary in Brushes



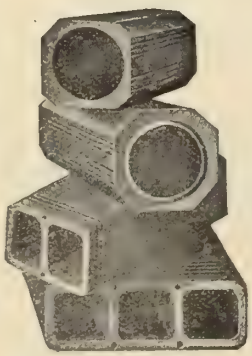
to keep the mica insulation of the commutator flush with the copper segments.

TUNGSTEN Pure Carbon Brushes

are classified in an entirely new way which makes it easy to select the brush best suited to your service. We classify brushes with respect to voltage, current density, resistance per cubic inch and abrasiveness——the latter under seven divisions.

Pure Carbon Company

Wellsville, N. Y.

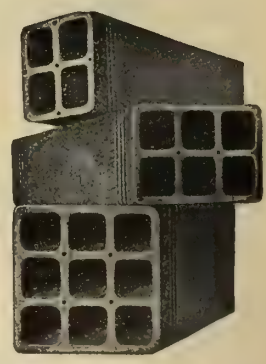


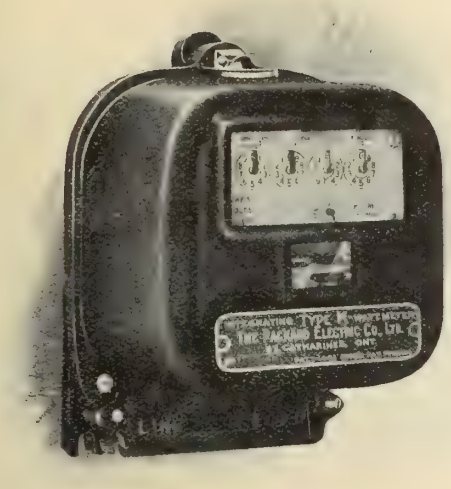
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Multiple and Single Duct Conduit for Underground Work

We challenge the world on finish and durability of our material. Our plant is located giving us the lowest freight rates to Canada.

B. S. BARNARD, Vice-Pres. **50 Church St., New York City**





Metal Case Type "K"



Polyphase Type "PK"

METERS are the watch men of your power and light circuits—

PACKARD METERS

of the new improved construction are at all times

Accurate and Reliable

IT is this permanent efficiency which makes "Packard" Meters the best types to use on your lines. We have incorporated many improvements which make them doubly sure of giving lasting satisfaction.

Look out for your revenue and at the same time give your customers satisfactory service by installing "Packard" meters on your lines.

Many types in metal or glass cases for circuits of all descriptions.

Large stock carried at

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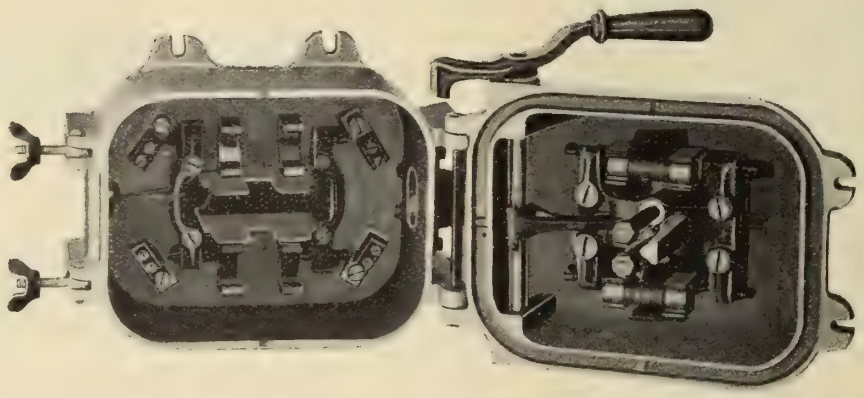
The Packard Electric Company, Limited

Factory at—ST. CATHARINES

General Sales Office :
901-902 Traders Bank Building, TORONTO
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CENTRAL STATIONS

Should Control Their Circuits



FOOL-PROOF

Ironclad Fused-Switch Gear.

PROTECTION TO LIFE CANNOT BE TAMPERED WITH.

Increase Your Revenue

Write for Bulletins to

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324 Smith Street, - - WINNIPEG

Murray Patents

Why Guess at Best Methods

of

Sealing and Protecting Your Meters and Services

Your distribution system may be excellent in every other respect

but are you

Protecting your meters and system by sealed service fuses?

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Experience counts, experience begets co-operation in engineering, manufacturing, assembling, testing and operating.

We have the experience of some of the best meter engineers and superintendents, and have made protective devices for all kinds of metered services for a great many small stations, and for the largest operating systems on this continent.

Why Guess, Why Theorize at Best Methods when it is unnecessary?

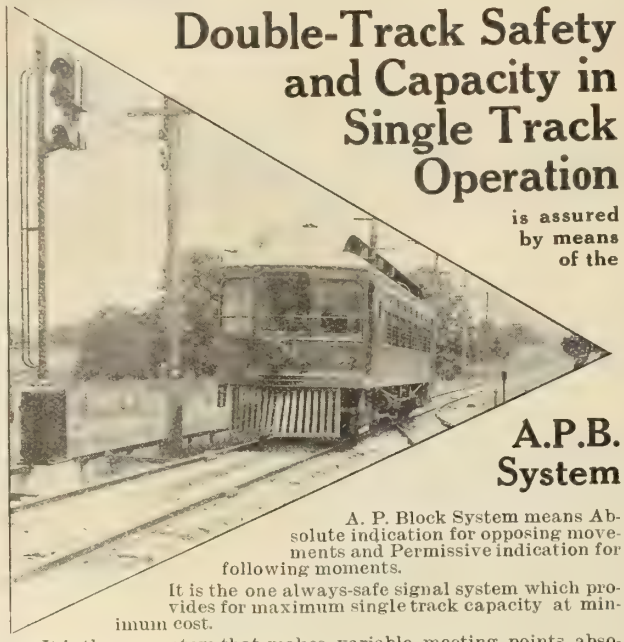
Write to us for particulars of "best methods of protected metered services."

Metropolitan Engineering Company

of Canada, Limited

90 Sherbourne Street

Toronto, - Canada



Double-Track Safety and Capacity in Single Track Operation

is assured by means of the

A.P.B. System

A. P. Block System means Absolute indication for opposing movements and Permissive indication for following moments.

It is the one always-safe signal system which provides for maximum single track capacity at minimum cost.

It is the one system that makes variable meeting points absolutely safe and prevents one delayed car from demoralizing the schedules. Now is the time to investigate.

"Safety First"

GENERAL RAILWAY SIGNAL COMPANY

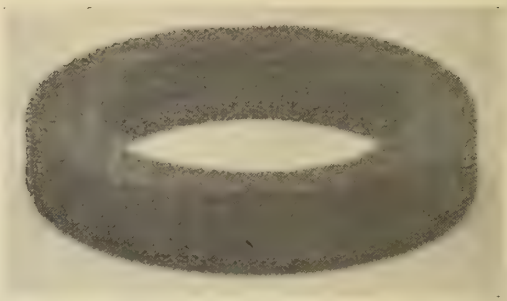
OF CANADA LIMITED

Office and Works
Lachine, Quebec

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Winnipeg, Man.

Booth

Mechanical Felt Goods



At Gananoque, Ont., we have the dies, the plant, the felt, the men and the experience to turn out mechanical felts that are cheaper and better than can be obtained from any other source.

If it's made of felt, ask Booth

The Booth Felt Co., Limited

GANANOQUE, ONT.

Branch of N. E. BOOTH, Brooklyn, N.Y.

McEWEN ENGINES



Backed up by a guarantee

READ IT—"The Engine shall not run one revolution slower when fully loaded than when running empty, and a reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of the engine one revolution."

For the Economical Generation of Electric Light and Power

Close regulation—the first essential for this class of work—is provided in the McEwen Engine by the famous Begthrup Inertia Governor.

Simplicity and accessibility of all parts, great strength and the ability to absorb a large overload without change of speed, are distinguishing features of the McEwen.

The merits of this engine have been shown not so much by its good performances under favorable conditions or when carefully nursed on the testing floor, but by its splendid record under all conditions, good, bad and indifferent, of actual practice.

Built in simple and compound units up to 700 h.p.

Send for a McEwen Booklet

The Waterous Engine Works Co., Ltd.

Brantford, Canada

Protection from Lightning Troubles

(MOSCIKI SYSTEM)

The following list of users of the Mosciki System of Lightning Protection speaks for itself:

Victoria Falls and Transval Power Co.
Shanghai Municipality.
Melbourne Electric Supply Co.
Cleveland and Durham Power Co.
St. John Del. Key Co. Brazil.
Societa Dergano.
Sociedad Espanola, Madrid
Societa Electrica Suburbana, Milan. &c.

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

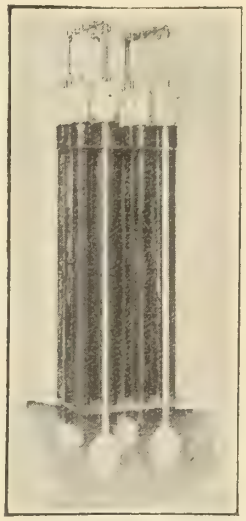
A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage— is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

Mosciki Lightning Arrester

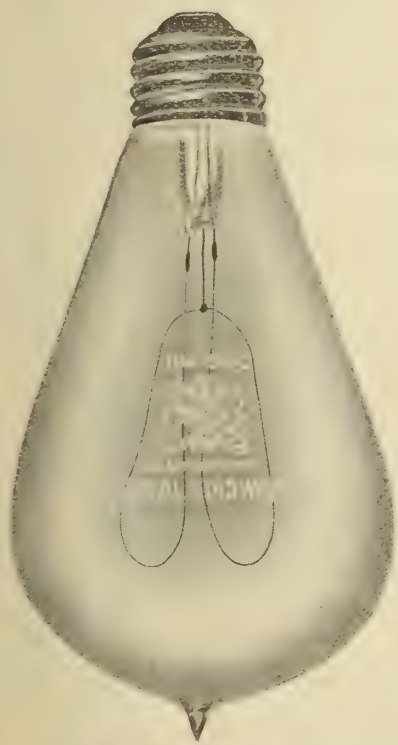


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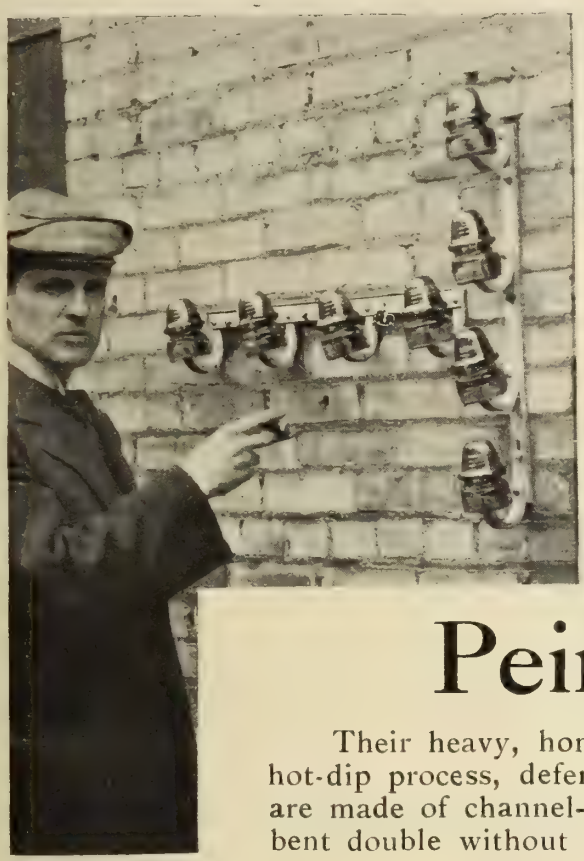
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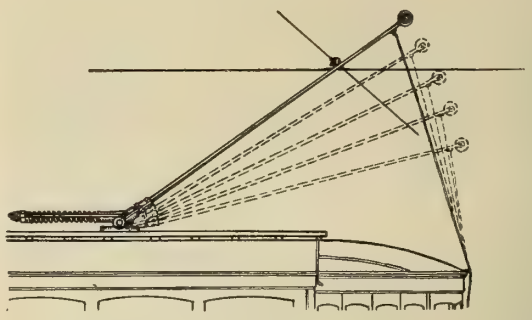


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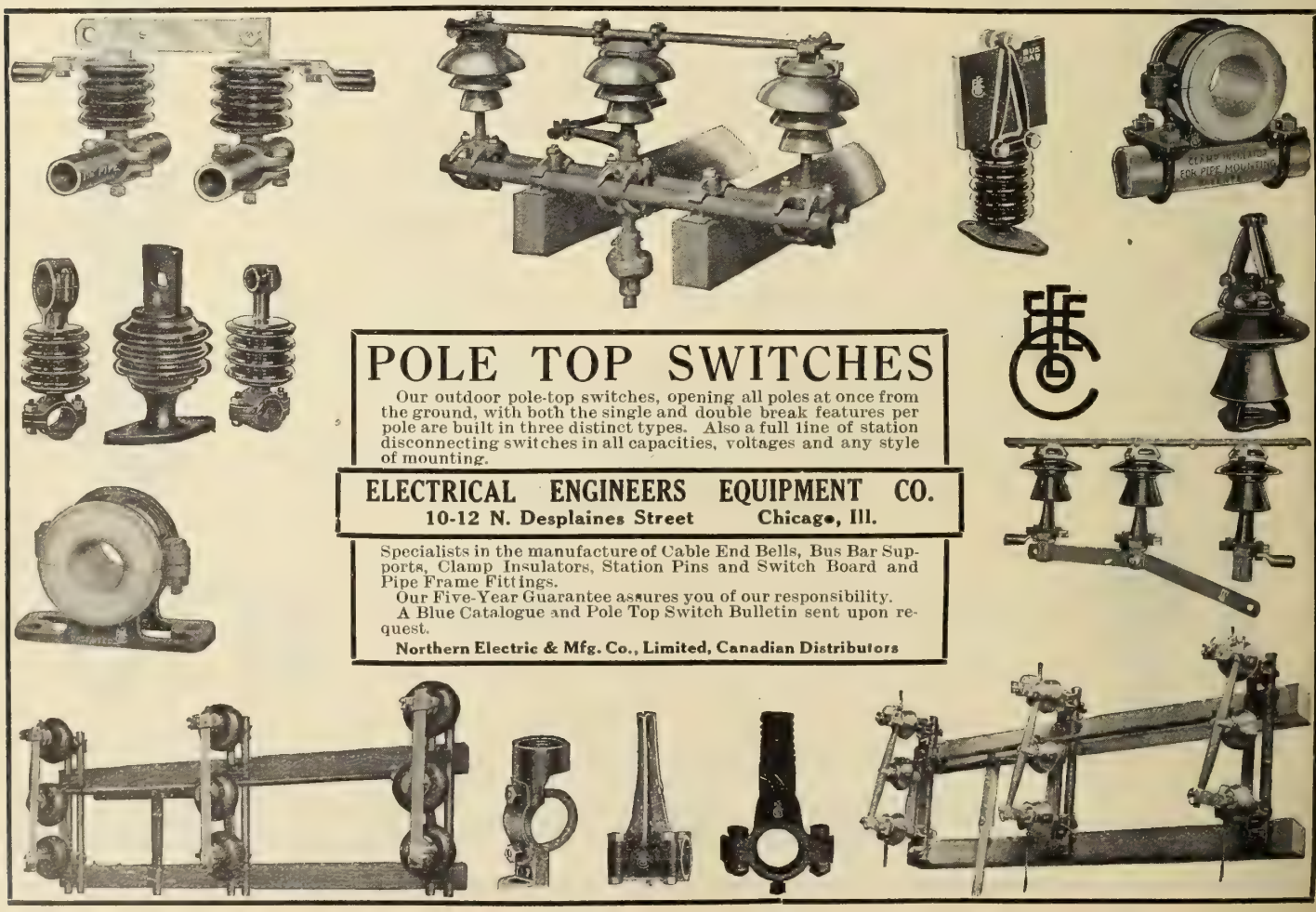
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The Self-Contained Car in Practice

Sufficient experience has now been gained with cars of the self-contained type that their success is no longer a matter of conjecture. In reliability of operation and reasonable cost of maintenance, expectations appear to have been more than fulfilled and the rapid increase in the number of installations also indicates that this type of car is meeting the requirements of certain kinds of service in a very satisfactory manner.

A paper printed elsewhere in this issue gives details of the developments leading up to the modern type of gas-electric car and also shows by statistics, the extent to which this class of equipment is now being used in the United States. Operating figures are also given in two typical systems where the cars have been operating for some time. These latter are particularly interesting as indicating that the estimated figures on operating costs are being more than fulfilled, even though the conditions surrounding operation can scarcely yet be quite normal. On the two systems in connection with which figures are quoted the general practice has been to operate two-car trains—a motor car and one trailer—and these figures show costs per motor-train-mile in no case exceeding 18 cents. The cost per car mile works out to slightly more than 13 cents.

In two out of three cases quoted the item of wages is considerably the largest item, running anywhere from 30 per cent. to 40 per cent. of the total operating expense. Fuel cost comes second, these two items representing about two-thirds of the total. Of three cases quoted the number of gallons of fuel (naphtha) per motor-train-mile is given, respectively, as .72, .75, .75; the number of gallons per car-mile is given in two instances as .49 and .52. The fuel phase of the question is an important one and advances in this direction, which are likely, must result, almost in the same proportion, in further popularizing the self-propelled car for interurban service.

Public Utilities Accounting

One of the weaknesses underlying the control of public utilities by municipalities is the lack of a sufficiently accurate or standard system of keeping account of the cost of operations. It is to be supposed that every municipality is anxious to so conduct its financial affairs that the promise of the present will be borne out by future events but how often have we seen it happen in Canada, within the last decade, that the roseate prospects and promises of the first year or two of a municipal public utility's operation is followed by a period of deficits, unsatisfactory service, resignations of disappointed operators, public criticism, etc., all of which might, possibly, have been avoided if a more cautious, systematic course had been mapped out at the start. Much of this, no doubt, can be charged to lack of system, a weakness which for the time being, deceives those in control and leads to unjustified statements regarding earnings and surpluses.

In a paper printed elsewhere in this issue Commissioner Robson of Manitoba makes a plea for the establishment of a standard system of accounting of public utilities and takes occasion to include also privately as well as municipally owned systems. He argues that, in either case, the public is in a sense, a co-partner in the business and, as such, entitled to the fullest information; that it will be a distinct protection to honestly administered utilities; that it would be a means of defense against unfair attack; that the information is needed before a correct judgment can be made regarding further expenditure; and finally that this applies equally to privately or municipally controlled systems. The Commissioner briefly outlines a system of bookkeeping which is at the same time simple and efficient and enumerates what the different Canadian provinces have accomplished in this respect.

For the most part the article will appeal to those in charge of public utilities as reasonable and helpful. There is however a very natural feeling existing in the minds of many of these operators that the "general public" is much better without this kind of information inasmuch as their interpretation is not likely to be either accurate or judicial. Accounts, by all means, should be kept properly and should be free of access to the proper authorities, but an accounting to the news-paper public looks to be a ridiculous proposition in the present state of our mathematical civilization.

Long Sault Development

The Dominion Government has just issued a voluminous report setting forth at length the developments to date regarding the proposed use of the water power at the Long Sault, St. Lawrence River.

During the last two or three years a very active campaign has been waged by the Long Sault Development Company, and others, to obtain the privilege of constructing a generating plant at this point. The following paragraphs from the introduction indicates at the same time the cause of the preparation of the report and its scope.

"The question whether private corporations and individuals shall, or shall not, be permitted to construct works for the development of power in the St. Lawrence river, is one of vast importance to the people of Canada. The present is deemed an opportune time to review the facts. The great possibilities of injury to the interests of Canada, the enormous potential values of the franchises; the possibility that, within the lifetime of many men now living, electrical heating will, in Canada, supersede in part the burning of anthracite coal; the certainty that, within a few years, it will be possible to

economically transmit electrical energy to much greater distances than at present, thus bringing southern Ontario and western Quebec, and the cities of New York, Jersey City, Newark, Boston, New Haven, etc., within economic radius of the rapids of the St. Lawrence; these, and many other considerations demonstrate that to conserve her greatest interests, Canada should adopt a well-considered and cautious policy.

"In this connection the activities of the Long Sault Development Company, which, during the last few years, has been seeking to acquire a franchise for the development of the Long Sault rapids in the St. Lawrence are of interest.

"In order to understand the true import of the Bills on behalf of the Long Sault Development Company presented to the United States Congress and to the Parliament of Canada it is necessary to make a brief study of the various other interests which are combined and associated with that company. In the following report the principal facts essential to such study are set forth."

Montreal Electrical Society

By permission of the Montreal Light, Heat and Power Company, members of the Montreal Electrical Society on Saturday, September 6, visited the company's power plant at Richelieu, P.Q. A special car of the Montreal & Southern Counties Railway was engaged, the party numbering about 100. Mr. P. T. Davies, the ex-president of the society, conducted the members over the plant, and explained the equipment. The plant was designed and erected by the Stillwell-Beirce and Smith-Vaile Company, Dayton, Ohio, in 1897.

In a statement made prior to the inspection, Mr. Davies pointed out that the installation was interesting from the point of view of its age, it being one of the oldest water-power stations in Canada. It had not been materially changed since it was built. The River Richelieu was, before the dam was constructed, 20 feet lower than at present. The machinery consisted of two old types—part of the generators were built on the S.K.C. system (they were supplied by the Royal Electric Company, Montreal). In addition there were four generators supplied by the Canadian General Electric, these being 2-phase, 2200 volt. The normal output was between 10,000 and 12,000 horse power, but more could be carried if required. The transformers (by the Westinghouse Company) were air-cooled by means of Sirocco fans. There was a 40-foot head of water. The current was stepped up from 2200 volts to 25,000 volts, and converted from two-phase to three-phase.

The turbine equipment consisted of horizontal water wheels enclosed in pits. There were four lines from the station to Montreal, a distance of about twenty miles. The four cables of 25,000 volts had never given any trouble. The governors were of the Lombard type, and the company had replaced the individual oil pumps on each governor by a central pump which had been entirely satisfactory. The ice situation needed very careful handling, and two years ago the suspension bridge below the tail-race was carried away, but the experience gained since the construction of the plant had enabled the company to control the situation satisfactorily.

After the inspection the visitors spent an hour at the residence of Mr. Davies and were supplied with light refreshments.

The suburban railway line connecting Sutherland with Saskatoon is almost completed and it is expected the line will be in operation during October. The expense of construction has been borne by certain real estate operators who expect to reap dividends in the increased value of their land. The line will be presented to the city of Saskatoon who will operate as part of their system.

Renfrew's Municipal H. E. System

The new hydro-electric plant for the town of Renfrew, Ont., which is situated on the Bonnechere River, a tributary of the Ottawa, was recently placed in operation. The capacity of the plant is 500 kw. but as sufficient water is not always available, it was deemed advisable to install auxiliary steam equipment in the same station, this latter being of sufficient capacity to operate one of the generators. A complete description of the equipment installed in this plant follows.

The general plan of this power plant has already been illustrated in earlier issues of the Electrical News. The dam



Municipal power house, Renfrew

is built immediately above the old traffic bridge with the idea that at some future date the bridge will be rebuilt to suit the town's growing requirements. This dam is of the stop-log type and will serve to a considerable extent as a means of regulation of the water supply. The stop-logs are handled by a hand operated travelling winch.

The headrace is some 350 feet long. There is only one retaining wall, which is on the river side of the headrace, the old shore line being the other side. Three racks at the power house guard the entrances to the two power units, and also to the water wheels operating the turbine driven pump. The clear water pipe extends from the old pumping station down the left bank of the river to the dam, crosses the river under the dam and down the centre of the head race



Dam, intake side, Renfrew town plant

to the pumps, from which it is pumped through the pressure filters into the town main.

All the construction work is carried out in concrete either mass or reinforced with the exception of the power house building, which is of cement, brick outside and red brick inside.

The turbine equipment consists of two horizontal type, double wheel, centre discharge, reaction units, supplied by

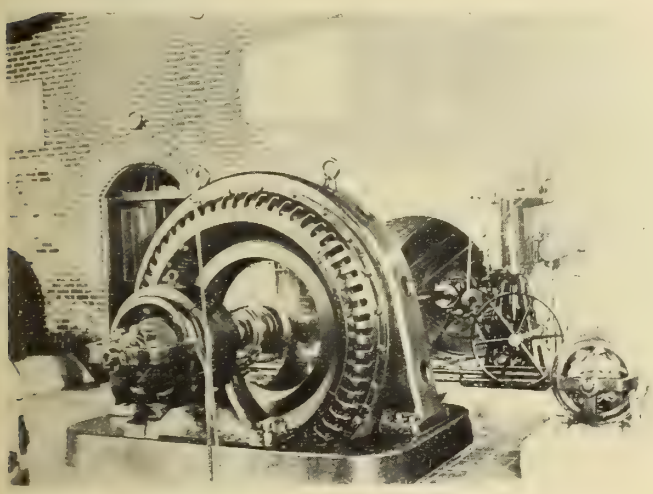
the S. Morgan Smith Company, of York, Pa. These are built to operate under a 36-foot head at 400 r.p.m., and are calculated a maximum of 400 h.p. per unit.

Generators are horizontal type, 60-cycles, 2-phase, 2,300 volt, 400 r.p.m. revolving field water-wheel type, of 250 kw. 25 per cent. overload. They were supplied by Messrs. Kilmer, Pullen & Burnham, Canadian agents for the Swedish General Electric Company. One of the generators carries its exciter on the same shaft. A second exciter is so placed that it can be belt connected to either generator.

Owing to the varied flow of the Bonnechere River and also to guard against interruptions to the power supply from other causes, the precaution has been taken to install an alternative prime mover in the form of a Belliss and Morcom steam engine of sufficient capacity to drive one of the generators. This particular generator therefore can be connected either with a water turbine, or if occasion requires, with a steam engine.

The boiler room equipment consists of 2 boilers of 75 h.p. each, transferred from the old plant and a new 150 h.p. boiler. The boiler plant is fitted with motor driven fan for induced draft and is capable of raising a full head of steam from cold water in less than one hour.

The pumping equipment consists of one Drysdale turbine pump with a capacity of 1,100 gallons per minute at 110



One generator, exciters and governor, Renfrew.

pounds pressure. This pump is direct connected to an S. Morgan Smith double runner turbine. Provision is further made for duplicating this equipment. There is also installed a Canada Foundry motor-driven turbine pump which has been transferred from the old pumping station and has proven capable of delivering 700 gallons per minute.

Special care has been taken in the design of the dam to prevent ice troubles. At the entrance to the flume submerged arches have been installed, similar to those now in use at the Mississippi River Power Company's plant at Keokuk. The curtain wall of the Renfrew plant differs from others however, in that it is inclined up-stream at an angle of some 40 degress to the horizontal. As a further precaution the racks at the power house are wholly submerged in order to prevent radiation.

The town plant is so constructed that it can operate in co-operation with the plant of the Renfrew Power Company. The generating equipment in the latter's station is water power driven by about 700 kw. capacity, 2-phase, 60-cycles, 2,300 volts. The generators are C. G. E. manufacture.

The governors provided for the regulation of the turbines are of the Lombard type. The switchboard consists of 8 panels of blue Vermont marble 2 inches thick, 65 inches high x 24 inches wide, designated as follows:—1 house lighting panel, 2 power panels, 1 arc lighting panel, 1 exciter panel, 2 generator panels and 1 spare.

The plant was installed under the immediate direction of Mr. J. R. Stewart, town engineer of Renfrew. Mr. J. B. McRae, of Ottawa, was the consulting engineer.

A Farmer's Isolated Plant

At Alberton, P.E.I., a small generating equipment operated by a gasoline engine, has recently been installed by the Canadian Fairbanks-Morse Company, for Mr. B. I. Raynor, the owner of two large fox farms.

The equipment consists of a gasoline engine, a generator capable of lighting continously 50-12 candle power tungstens, a switchboard, and an auxiliary battery. Photographs taken of this installation are shown, herewith, in Figures 1, 2, and 3.

Dynamo

The dynamo is a Fairbanks-Morse compound wound multi-polar self-regulating machine, having a capacity of 25 amperes at 32 volts. It is heavily and sturdily built, the aim being to produce a machine that will not merely give its rated capacity for a temporary period, but will continue to give efficient service for years without causing the expense and inconvenience that would be incidental to cheap and light construction. It gives a steady, brilliant light, and regulates automatically, producing only the amount of electricity required, whether its entire capacity or only a single light may be burning, thus saving the consumption of fuel when running only a part load. The current generated is of low voltage and is entirely harmless so that any unpleasant results from accidental contact with uninsulated parts of the machine are avoided.

Engine

The engine is the Fairbanks-Morse 2 h.p. special electric oil engine and is designed and constructed for this service. It is of the 4-cycle type, with throttling governor, extra heavy fly wheels and bearings and an efficient lubricating system which permits of its operating for long periods with little attention. Its regulation is exceptionally close, as required for electric lighting service, and the special governor permits of directly driving a standard dynamo without resorting to extra balance wheels.

Storage Battery

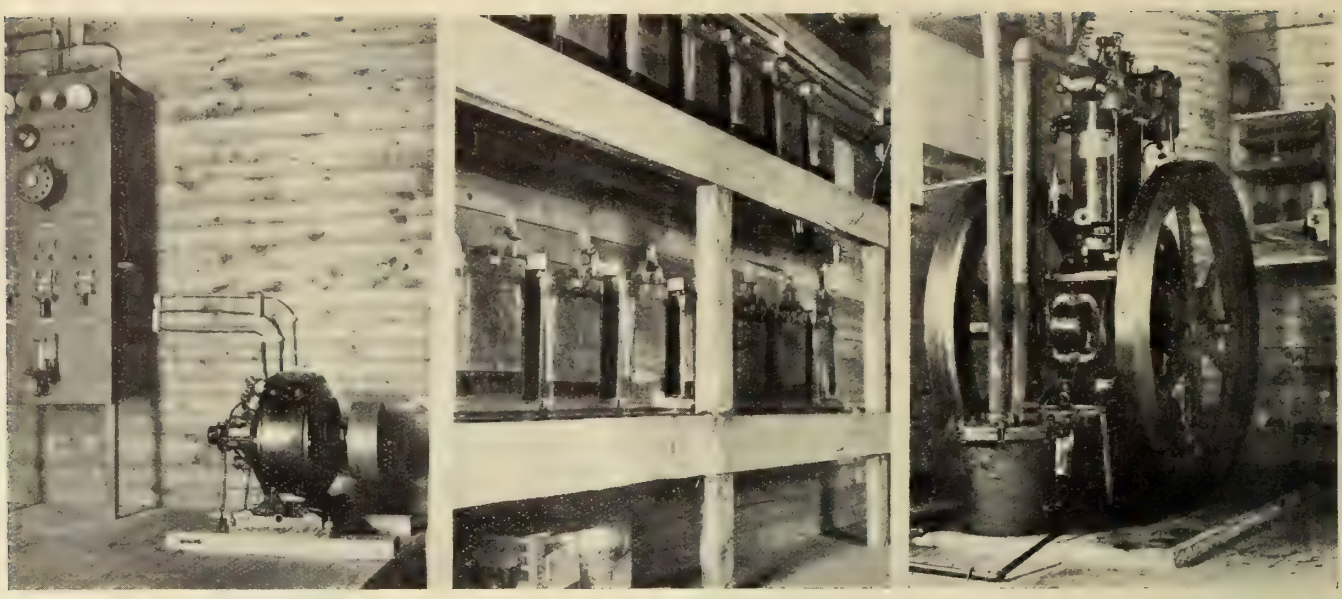
The storage battery consists of 16 cells of the Electric Storage Battery Company's chloride accumulators. The battery, when fully charged will furnish enough electricity to run 9 lights for 7½ hours, 13 lights for 4¾ hours, 18 lights for 2¾ hours or 30 lights for one hour. When fully discharged it requires about ten hours to completely recharge it. Under ordinary conditions of service, most of the lighting being done direct from the dynamo, the battery need be completely recharged only once or twice a week.

Switchboard

The switchboard is a handsome marine finish slate slab, mounted upon angle iron supports and provided with wall braces which hold it at a suitable distance from the wall. On the face of the panel are mounted the following instruments:— 1 voltmeter; 1 ammeter; 1 double pole, double thrown mainline switch with fuses; 2 double poles, double throw battery switches; 1 rheostat for adjusting the voltage of the dynamo; 2 pilot lamps, with battery charging resistance; 12 voltmeter receptacles; 1 four-point voltmeter plug; 1 underload circuit breaker.

Other Uses

While especially designed for electric lighting, this plant



A private plant at Alberton, P.E.I.—From left to right, switchboard, generator, batteries and gas engine

provides many other conveniences, and may be used to operate a wide variety of labor-saving devices. Power for any purpose is available wherever the plant is installed, by simply attaching another pulley to the engine, which can then drive a pump, saw wood or operate other light machinery. Electric motors render this power available at points distant from the plant. The engine or an electric motor may be used to drive a compressor and thus make water, fresh from the well, instantly available at any desired point. The plant may also be used to operate electric flat irons, washing machines, sewing machine motors, electric fans, vacuum cleaners or even do light cooking.

Power Development at Long Sault

Extracts from Recent Report of the Commission of Conservation on the Long Sault Project

"To the cursory reader it would appear that one of the principal purposes of the Charter held by the Long Sault Development Company purports to be the improvement of navigation. The preamble of the Act, for example, states that it is:

"For the purpose of improving the navigation of the St. Lawrence river."

And, again, for:

"the permanent improvement of navigation of the St. Lawrence river at and above and below said place."

The Charter, however, does not stipulate or impose upon the Company any specific requirements for the improvement of navigation. It only recites that:

"The navigation of the St. Lawrence river ..... shall be preserved in as good condition as, if not better than, the same is at present, regard being always had to the amount of the natural flow of water in said river as affecting its navigability from time to time."

As the Federal Government of the United States has paramount jurisdiction over navigable waters, the Act of the New York State legislature, Chapter 355, Laws of 1907, requires that the Company shall obtain authority from the Congress of the United States to construct the dams, locks and canals referred to in the Act, and then, the Act further provides, that, after receiving proper authority from Congress, the Company may have, on application therefore, a formal grant of title to the portion of the bed of the river that is to be covered by the structures, and the Commissioners of the Land Office are commanded to make such conveyance. Not only the charter, but the privileges granted, are unlimited as to time.

The Long Sault Development Company, when it shall have complied with the requirements of the Federal law, and upon the terms prescribed by the statute, will—to use the statement made by the Company before the Committee on Rivers and Harbours:

"become vested with (a) the tile to that part of the bed of the St. Lawrence river which it is necessary to use in the construction of the works contemplated by the Act, and (b) the right to construct and maintain such works and to enjoy to the exclusion of all others the right to divert and use for purposes of operating its works, the surplus waters of the St. Lawrence river; subject, however, to such regulation either in respect of the character of the works or the use of the water of the river as the Federal Government (and to some extent, pointed out below, the State Government) may from time to time impose in order to maintain unimpaired the navigability of the river."

It will therefore be perceived, that the primary object of the Bills that have been introduced, and those that are at present before the Congress of the United States, is to secure the Federal authority specified in the Act which the Long Sault Development Company obtained from the state of New York. Once this authority has been obtained, the Company may have, on application therefor, a formal grant of title to the portion of the river-bed that is to be covered by its structures, canals, etc. Such a grant, apart from international considerations, would practically give the Company domination of the situation.

Present Danger in Proposal to Dam the South Sault

"The great danger at present—and it is a real danger—to Canada's rights in the St. Lawrence river, consists in the desire on the part of, and the efforts being made by, the Long Sault Development Company to construct a dam in the South Sault channel. The Company also proposes to construct a power house and lock across the channel, between the foot of Long Sault island and the main shore. This is part of the Company's large project to utilize the whole power that can be developed at the Long Sault.

This important project involves the erection of a dam some 3,800 feet long, between Barnhart island and the northeasterly end of Long Sault island. The channel between Barnhart island and Sheek island is to be widened to ap-

proximately 1,000 feet in width, and used for a power canal to convey water to the forebay of the power works which it is proposed to erect at the eastern end of Barnhart Island. At this point it is proposed to build a dam, having the shape of the letter V, approximately 1,450 feet long and adjacent, on the Canadian side, to Lock 20 of the Cornwall canal. It is proposed at this Barnhart Island power-site to utilize a head of about 40 feet. The proposed dam in the South Sault channel would utilize a head of about 35 feet.

The Company may also find it desirable to raise the level of the dam in the South Sault channel, so as to back the water up at the intake of the present canal leading to the power house at Massena, N.Y. The nominal head at the Massena power house is about 30 feet, but it is stated that some three or four feet of head is lost in the canal. At the present time this Massena power canal is being enlarged by dredging to permit the passage of an increased quantity of water to be delivered at Massena, where a new power house is under construction.

With respect to the extensive development proposed by the Long Sault Development Company, it is interesting to note the statement made, before the Committee on Rivers and Harbours of the United States House of Representatives, by Mr. James W. Rickey, Chief Engineer of the Company.

"This entire development," said Mr. Rickey, "is laid out with the idea of utilizing every bit of power that is available at this point ultimately—perhaps not while we are alive—but there is nothing done in this entire development that will hinder the complete development of the potentiality of the St. Lawrence river at this point. That is really a very important factor. Many water powers in the past, and comparatively a short time ago, have been imperfectly developed; they have just skimmed the cream off and prevented a complete development."

And, with regard to the project, Mr. G. R. Malby, who has introduced bills into Congress for the Company, says:

"There is just one more point. There seems to be some idea that the water which goes to the north of Barnhart Island is to be developed half in Canadian territory. If you get on to the scheme you will see that is not quite correct. The proposition, as Mr. Rickey will point out, is that the great power house of the entire scheme is wholly in American territory, at the foot of Barnhart Island; although the water itself passes through a portion of Canadian territory, the development takes place in the United States."

If the "great power house of the entire scheme is wholly in American territory" it does not, on the face of it, appear that Canada would have any control whatever over the Company.

Conclusion

"The Commission of Conservation opposes the granting of any charter to dam the Long Sault, on the following grounds:

(1) Inasmuch as the Ashburton treaty provides that "the channels in the river St. Lawrence on both sides" of Long Sault, Croil and Barnhart islands "shall be equally free and open to the ships, vessels and boats" of Great Britain and of the United States, no constructions which would interfere with navigation in the slightest degree can be erected in any of said channels without the consent of Great Britain.

(2) It is quite possible that serious damage would result from the construction of the works. Engineers have, it is true, given an opinion that there is no probability of such damage. On the other hand, the opinion of the residents along the shore and the most experienced navigators and observers is apparently almost unanimous in holding that the probability of serious damage is very strong. With all respect to the engineers who have given their opinions, it is submitted that the question is not an engineering problem and that no data exist for the formation of a reliable engineering opinion. No engineer can tell where or how ice will be formed when in our rigorous climate the flow of a mighty river is interfered with. It is a fact that slight interference has in former years caused great damage from floods and ice jams. The possible total stoppage of the flow of the river as a consequence of the works contemplated is a contingency which cannot be said to be impossible or remote. Such a stoppage would cause enormous damage to private property and would imperil the Cornwall canal, which is an integral and essential part of the all-Canadian water route from Lake Superior to the sea.

It does not appear necessary to express an opinion as to whether the weight of evidence or probability is in favor of the view expressed by the engineers or that expressed by the residents of the locality who have intimate knowledge of the history of the river for many years past. The fact that there is any—even the slightest—difference of opinion is a sufficient reason for condemning the proposal. No risk whatever should be incurred in a matter of such vital importance.

(3) The proposed diversion of water by the dam between the Long Sault island and Barnhart island would take from the main navigable channel between Barnhart island and the United States mainland about 50 per cent. of its water. The effect of such a diversion of water from the navigable channel is impossible to estimate. It can, however, be stated with certainty that the navigability of the channel would not be improved by such diversion.

(4) The construction of the dams in question will result in compelling navigation (other than by the Cornwall canal) to follow a new route known as the South Sault channel. Experienced navigators are of the opinion that this route will be much inferior to that now followed.

(5) The time will undoubtedly arrive in the history of Canada when deeper navigation upon the St. Lawrence will require to be provided for by the Canadian Government. Should the works proposed by the St. Lawrence Power Company be constructed, the government would no longer have a free hand in undertaking such an enterprise.

The vested rights of the company would require to be considered. Should the engineering plans adopted for improving and deepening navigation interfere with or damage the works of the company, which is reasonably certain to be the case, then the government would be under the necessity of expropriating such works and paying an enormous sum by way of damages. Moreover, it is not clear that such expropriation could be had on any terms. The international character of the works might prove an insuperable bar, in which case the government would be without remedy, and the improvement of navigation could not be effected.

(6) The proposed scheme of the St. Lawrence Power Company contemplates making use of the Canadian side of the river simply as a convenient landing place for a dam. A very slight examination of the plans of the company is sufficient to make it clear that only a small portion of the contemplated expenditure will take place in Canada and only a very small proportion of the total power developed, will be developed in Canada.

(7) Looking at the whole scheme, it does not appear that any serious attempt can be made to show that Canadian requirements or Canadian interests are an appreciable factor in the plans of the company. The plans contemplate the absolute monopolization of the whole power available from the rapids with a minimum consideration of Canadian interests.

(8) No market exists at the present time upon the Canadian side for the power proposed to be developed, or for any appreciable portion thereof. When any large quantity of power is required in the territory tributary to the proposed works it can be otherwise provided. There is, within the

radius of economic transmission, abundant power available for development in purely Canadian territory without interfering in any way with the St. Lawrence river.

(9) Should the time come when further power is demanded by Canadian interests, and the placing of a dam across the St. Lawrence river is determined upon, one-half of the power to be generated thereby will belong of right to Canada and should be permanently retained for Canadian use without any exception or qualification.

(10) The suggestion that power can be generated on the American side, or generated on the Canadian side and exported to the United States, and that thereafter, when it is required in Canada the company can be ordered to deprive its United States customers of the power and deliver it in Canada, is regarded as being entirely illusory. If the power is used in the United States, industries will be built up and vested interests created thereby, which it will be impossible to ignore. The attempt to enforce an order for the delivery of power on the Canadian side after it had for years been exported to, or used in, the United States would lead to serious difficulties. The case is not the same as if the company and its works were wholly within Canada. If the company desired to avoid or resist such an order, no means would exist of enforcing it without resorting to steps which would be a sure road to international complications.

(11) Although not at present required for actual use, the power possibilities of the St. Lawrence at the Long Sault are very great, and the time will undoubtedly come when they will be of enormous value. The present proposition contemplates giving away this valuable asset, without any substantial consideration, to a foreign company for its private financial advantage.

(12) The obvious conclusion from the facts above recited seems to be, that the plain duty of Canada is to maintain her rights of ownership and jurisdiction absolutely unimpaired and untrammelled."

Motor-Driven Fire Pumps

By Mr. H. P. Reed

While the squirrel cage motor has been used in a few instances for the driving of fire pumps, it's starting characteristics make it inferior to the slip ring type motor for this service. Since it is necessary that the fire pump be started without chance of failure, when needed, the motor equipment and control have received more than ordinary attention.

A book of rules issued by the National Board of Fire Underwriters covering all types of fire pumps was published in 1904. These rules have been partially, at least, superseded by the rules made by the same Board in 1911. The 1911 rules bear the title "Rules and Requirements of the National Board of Fire Underwriters for Centrifugal Fire Pumps," and they require a switchboard controlling the motor to contain a suitable switch, a voltmeter, an ammeter and a circuit breaker. These parts are in addition to the starting apparatus. The rules also require that the switchboard must be protected from water coming in from the possible leakage or breakage of any connections at the pump or other piping in its vicinity. These specifications give in general the requirements for the control board. Much is left to the contractor or pump builder, for he must decide upon the type of motor to use.

There are two types of alternating current motors that have been used for fire pump work; the "squirrel cage" and the "slip-ring" type. It is generally conceded that the squirrel cage motor is adaptable to many installations due to the fact that it has not the complications of a slip-ring motor. The brushes on a slip-ring motor are liable to spark and the starters for a slip-ring motor necessarily have arcing contacts. For fire pump service, however, where the motor and controller are always properly enclosed, the objections to the slip-ring motor are overcome and there are many reasons why this type of motor is better adapted to fire pump work.

From an engineering and from a safety viewpoint, the squirrel cage motor is rather undesirable. The principal objections to this motor are its high starting current and its low starting torque. Combined with these features is the fact that it is impossible for an unskilled operator to accelerate a squirrel cage motor without danger of taking a very high current from the line and the possibility of tripping the circuit breaker. In times of excitement when there is a fire and when the night watchman is liable to be called upon to start the fire pump, he will not wait sufficiently long on the starting "tap" for the motor to accelerate properly, but will be very much inclined to throw over quickly to the running position. This will draw a very high current from the line, and as in this position the overload release coils of the circuit breaker are in circuit, the circuit breaker will be very liable to be tripped out. This will necessitate the re-setting of the circuit breaker and starting all over again with resultant delay and probable increased loss of property.

Slip-Ring Motor Suited For Fire Pump Duty

A large squirrel cage motor will take from 7 to 8 times full load current with the rotor stalled and full voltage applied to the motor terminals. Even with the most skillful operator, the motor, as ordinarily provided with a potential starter, will take at least four times its full load current from the line. If the operator is in a hurry he is apt to make the motor take 6 or 7 times full load current and under these conditions the circuit breaker will trip out. In order to equalize the starting surges the operator should leave the motor on the starting tap until the motor has reached 80 per cent. of full speed. This takes a comparatively long time, and the tendency is to throw the motor on the line too quickly.

The low starting torque of the squirrel cage motor is a very objectionable characteristic for fire pump service. The starting torque developed on a moderately sized fire pump squirrel cage motor with about half voltage at the motor terminals, is not over 25 or 30 per cent. of full load torque. Where such a motor is installed in a comparatively high building, the motor will possibly not be able to accelerate at all on account of the pressure head. The squirrel cage motor is therefore vastly inferior to the slip-ring motor for fire pump installations where reliability and ease of operation should be the primary considerations.

In acceleration, the latter type of motor acts similar to the shunt wound direct current motor, and while the results in starting are not equal to the compound wound direct current type the starting torque is sufficiently high to allow the motor to be accelerated quickly and easily without taking a heavy current from the line, and therefore without danger of tripping the circuit breaker. The slip-ring motor is consequently better than the squirrel cage type for fire pump duty.

The controller for the fire pump motor must be simple in design, easy to operate and reliable. The Cutler-Hammer Manufacturing Company, of Milwaukee, have recently put a new type motor driven alternating current fire pump controller on the market. The one shown in the illustration is for a 100 h.p., 440 volts, 3-phase, 60-cycles slip-ring motor. Mounted on the control panel are a voltmeter, an ammeter, a three-pole rigid arm plain overload circuit breaker, a three-pole double-throw knife switch, a pressure governor and a combined manual and automatic fire pump motor starter. At the back of the panel in a suitable angle iron frame are mounted the cast iron resistance grids which are used as the

starting resistance in the secondary circuit of the motor. The whole controller is enclosed in a sheet iron splash proof case mounted on a pedestal two feet high.

The double-throw knife switch is for transferring the motor from one set of service lines to another, as connection to two separate power lines is often provided for reliability. The starter proper consists of a square shaft above which are mounted the three primary and the six secondary cam operated switches. There is also an auxiliary cam operated switch at the extreme right, the function of which is described below. The cam shaft, which actuates these switches is revolved for manual operation by a hand lever shown at the extreme left of the shaft.

Manual Operation Important

The manual operation is of primal importance and it is only necessary for the operator (who may be an inexperienced night watchman) to pull the hand lever from the upper position through 180 degrees to the lower or full running position. The lever is held in the running position by an automatic release coil. The movement of the lever above described first closes the three primary switches simultaneously and then closes the secondary resistance switches in proper succession, until the motor is brought up to full speed. The secondary switches are so designed that the resistance is cut out of each phase at the same time in equal portions and thus the motor is kept balanced all during the starting period. On failure of voltage or at the will of the operator the switches are all opened, the shaft being returned by a heavy clock spring.

Need For Automatic Control Also

If automatic control can be conveniently incorporated without complication of the hand operation, it gives a satisfactory method for maintaining a constant water pressure when a single sprinkler head opens or when a leak develops in the piping system. Furthermore the automatic operation provides a safety feature which is not available in a straight hand starter. Watchmen are prone to leave the building or the section of the building where the controller is installed and in case of fire the automatic control feature is a decided advantage as it puts the pump in operation and keeps the pressure up to maintain a sufficient water supply.

As in the hand operation, the cam shaft is revolved to start the motor, but the operation in this case is taken care of automatically by a pilot motor mounted on a bracket below the right hand portion of the shaft. This motor drives the shaft through a worm gear reduction box, the gears running in oil. A solenoid operated clutch is between the reduction gear box and the cam shaft. The automatic starting operation is as follows: when the pressure in the tank or stand pipe falls below a predetermined amount, due to opening of sprinkler heads, leads, etc., the pressure governor cioses the control circuit for a small two-pole magnetic switch located just above the cam shaft at the right hand end. This switch closes and opens the pilot motor circuit. At the same time the governor closes the clutch solenoid circuit. The pilot motor revolves and a spring behind the movable jaw clutch member is compressed by the clutch solenoid. As soon as the jaws match, the spring causes the clutch to engage and the cam shaft is revolved. The three primary switches are closed quickly due to the shape of their cams. The secondary switches are then closed in succession, cutting resistance out of the motor rotor circuit just as in the case of hand operation. After the last secondary switch is closed the auxiliary cam switch opens and drops out the pilot motor switch, thus stopping the pilot motor and preventing further revolution of the cam shaft. The worm gear reduction prevents the motor revolving backwards, and keeps the switches in the running position with the fire pump motor up to speed.

The clutch solenoid remains in until the pressure in the sprinkler system reaches the required maximum, when the pressure governor opens the circuit to the clutch solenoid, disengaging the clutch. The heavy clock spring returns the cam shaft quickly to the "off" position. The clutch solenoid is therefore the automatic and the no-voltage release, because the solenoid when de-energized allows the starter to return to the off position, stopping the motor.

The entire controller is built to meet the most rigid fire pump requirements. There is no iron to iron bearings and all parts are designed to withstand the effects of periods of idleness in damp locations. A fire pump controller must be ready to start on a moments notice even though it may have been idle for a month or more. The particular feature of this fire pump controller is its adaptability to either hand or automatic operation without any mechanical change.

Hysteresis Starting Resistance

By Mr. C. C. Clark

The hysteresis starter is specially adapted for use in connection with slipring type induction motors driving machine tools, hoists, cranes, elevators, etc., and in all cases where a large starting torque is required, and where a motor is required to start, stop and reverse very frequently. The construction and operation of the starter are extremely simple and there are no moving parts to wear or get out of order.

The starter consists essentially of three laminated cores placed one on the other as shown in Fig. 1. On each core

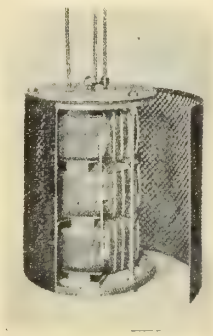


Fig. 1.

is wound a coil of wire. The three coils are connected in star. A diagram of connections is shown in Fig. 2.

The operation of the starter is quite automatic and the torque obtained from the motor at starting can be varied by changing the neutral point on the winding of the starter so that the correct amount of current will pass to produce the desired torque. The torque may in this way be varied through a considerable range. The starter is always left permanently connected to the slip-rings of the motor, and the motor is started by simply closing the primary switch. The moment the switch is closed the motor rotor will be standing still; consequently the frequency in the primary and secondary circuits will be the same and the reactance in the starter will be at the maximum value. As the speed of the motor increases, the secondary frequency and reactance in the starter decrease until the motor reaches nearly synchronous speed when it will be at the minimum value. Under these conditions constant torque is obtained during the starting period and by the use of steel of a special nature with high hysteresis losses, a high power-factor is obtained. The great advantage of this type of starter is,

therefore, simplicity in construction, which is especially desirable for heavy service. There are no moving parts or contacts to burn. A large starting torque can be obtained, from 2½ to 3 times normal torque, and the starter is practically indestructible.

The following is an example of the method used in the design of this apparatus. In the first place it is necessary to know the characteristics of the steel being used. The saturation curve of a suitable steel is shown in Fig. 3, also the power-factor curve. In the figure, B represents the flux density per sq. cm. From this curve it can be seen that the highest power-factor is obtained by working the steel at a density of about 12,000 per sq. cm. Using this value would, however, make the starter too expensive and it is necessary, therefore, to raise the density to 15,000 per sq. cm., which reduces the power-factor from 0.67 to 0.6. The starter must be designed to suit the motor it is to be used in connection with in order to obtain the best results, and to do this it is advisable to calculate two or three designs using a sufficient number of turns for each. For example, take a starter for an 8 h.p. motor. Assume the cross-sectional area of the steel to be 66.8 sq. cm. and the length of magnetic circuit 77 cm. and the number of turns for these designs 29, 20 and 11,

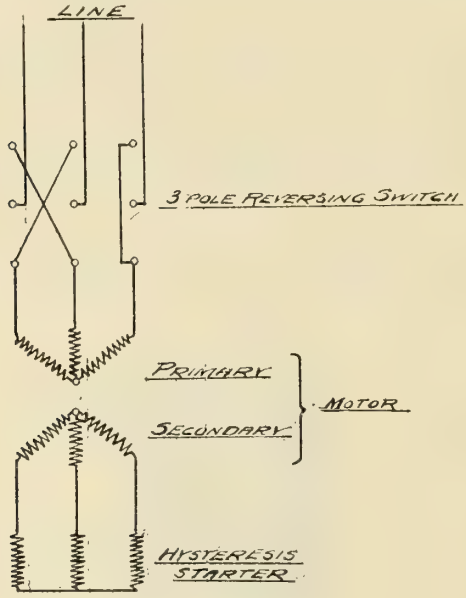


Fig. 2.

respectively. The voltage curve can be calculated from the formula:—

$$E = 4.44 \times N \times f \times d \times B \times 10^{8}$$

Where E is volts per phase; N, number of turns; f, frequency; d, area of total core in sq. cm.; B, intensity of magnetic field.

If we use 29 turns per phase and a frequency of 60 the results work out as follows:—

B	E	Amp. turns per c m	Amp. turns per ring	Amp.	P. F
4000	17.2	9.8	755	26	0.54
8000	34.4	13.2	1048	36.2	0.65
12000	51.6	17.8	1375	47.3	0.67
15000	64.4	23	1775	61	0.61
18000	77.3	33.8	2610	89.8	0.44

In the same way the results can be obtained using 11 and 20 turns respectively, see curves Fig. 4.

The calculations are made assuming that the motor rotor is at a standstill and the torque is figured accordingly. There is one point in each curve at which the motor will work to the best advantage. This point may be determined by marking off the open circuit voltage on the vertical scale and the rotor short circuit current on the horizontal scale. Join these two points by a straight line and the point where the line intersects the saturation curve shows where the starter will work to the best advantage with the motor for each respective number of turns on the winding, see Fig.

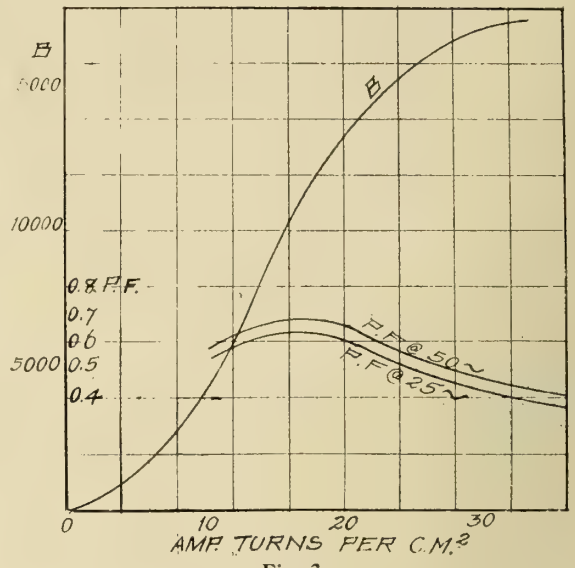


Fig. 3.

4. The best value for the secondary voltage of the motor is given by the formula:

$$E = \frac{\text{Primary volts}}{\text{ratio of turns} \times 1.04} \text{ where}$$

$$\text{Ratio of turns} = \frac{\text{prim. slots} \times \text{wires per slot}}{\text{sec. slots} \times \text{wires per slot}}$$

Assuming that the primary and secondary are connected in the same manner, the secondary short circuit current is given by the formula:

$I_1 = I_2 \times$ ratio of turns $\times$ 1.09

Where I_1 = secondary short circuit current and I_2 = primary short circuit current.

Now the torque is proportional to the losses in the sec-

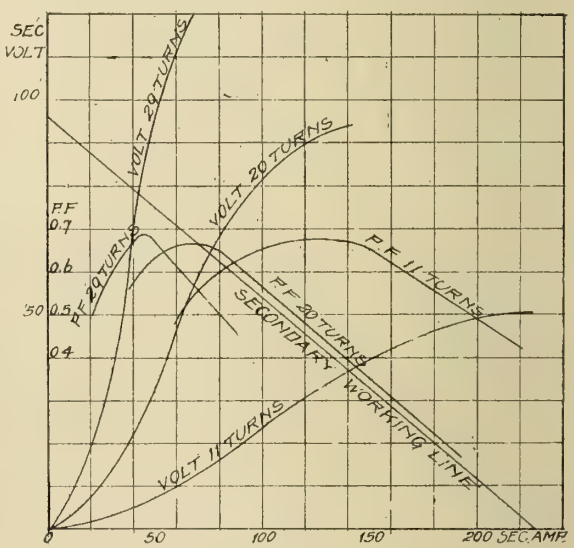


Fig. 4.

ondary circuit which are equal to the sum of the losses in the rheostat and the copper losses in the secondary winding. Therefore torque in horse power is given by the formula,—

$$\text{h.p.} = \frac{E_3 \times I_3 \times \sqrt{3} \cos \phi \times I_3^2 R}{746}$$

Where E_3 and I_3 are the voltage and current at the point

of intersection (Fig. 4) and R equals total secondary resistance of rotor and cos ϕ is the power-factor.

In the example above $E_3 = 87$, 65 and 37.5; $I_3 = 42$, 73 and 138; R = 0.15 and h.p. is, therefore, equal to 5.5, 8.5 and 11.9 respectively. From this, it is seen that the h.p. increases to a certain point as the number of turns decreases. If curves are plotted showing hysteresis, horse power, and copper losses as in Fig. 5, assuming the working power-factor is 0.65, the hysteresis losses are at a maximum value at half the short circuit current and half the secondary voltage but the copper losses are increasing all the time.

From Fig. 5 it can be seen that the total h.p. reaches its maximum at about 3/4 of the rotor short circuit current.

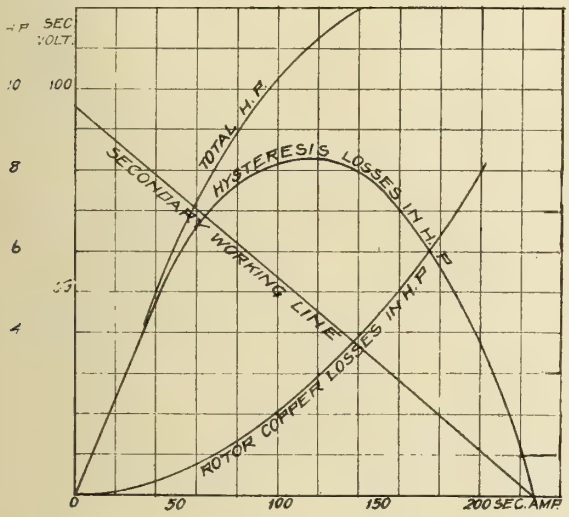


Fig.5.

The best working value is, therefore, with about half the short circuit current in the rotor or perhaps 20 per cent. above this amount.

The primary starting current is approximately:—

$$I = \frac{I_3}{\text{ratio of turns} \times 1.09} + I_0$$

Where I_0 = the no-load current of the motor.

From the above formulae it can be seen that the motor should be designed so that:

$E_1/2 \times I_1/2 \times \sqrt{3} \times 0.67 \times 1/746$ is equal to the torque required in h.p. Using primary values the torque in

$$\text{h.p.} = \frac{E_2 \times I_2 \times \sqrt{3} \times 0.67}{4 \times 746}$$

The motor must be designed for a short circuit current of

$$I_2 = \frac{\text{starting h.p.} \times 746 \times 4}{E_2 \times \sqrt{3} \times 0.67}$$

If the motor is designed for the short circuit given by the above formula, the rheostat can be easily adjusted, so that the motor, on starting, has half the secondary voltage and half the secondary short circuit current in the rotor. The hysteresis losses increase in proportion to the frequency. More steel is, therefore, necessary for a 25 cycle starter than for a 60 cycle starter.

The patent for this type of starter is held by the General Electric Company of Sweden.

The Montreal Tramways Company have ordered from the Canadian General Electric Company two 1,000 kw. motor-generator sets. One set is to be installed in the Cote des Neiges station of the Montreal Public Service Corporation, and the other in the St. Henry sub-station of the Tramways Company. The power for these machines will be delivered to the stations by the Montreal Public Service Corporation.

Exhibits at the Canadian National

Along with other departments of Canada's great national annual Exhibition, the electrical display continues to grow in magnitude and interest. This is especially true with respect to illumination fixtures, and heating and household appliances. The variety of fixtures this year is very great, and their designs probably more beautiful than ever, though possibly the most noticeable advance is shown in the varied appliances of electricity for the home, including not only irons, toasters, etc., but efficient heating and cooking appliances, sweepers, washing-machines, etc., applications which have been more tardy in arriving but which will mean more to the house-wife, in proportion as they relieve her of the heavier duties of household labor.

There is no doubt however that the electrical exhibit still fails to create as favorable an impression as its magnitude and the variety of the equipment shown should demand, on account of the scattered location of the various booths. Compare for example the satisfaction one gets in visiting the automobile exhibit, as compared with what it would be if these were scattered in all of the different buildings, so that one would stumble across certain manufactures only by the merest chance. The exhibit of electrical appliances will never receive its proper attention, or carry its full value, until a special building is set aside for electrical equipment alone. There is no question but that this building to the vast majority of visitors could be made the most attractive on the grounds.

Among this year's exhibitors, of special interest to electrical men, may be mentioned the following:—

Chadwick Brass Company—Supplemented their exhibit of decorative brass-ware with a number of handsome electric fixtures.

Lumen Bearing Company—Had a display of babbit metals; also a new type of car wheel for electric railways, that they have just placed on the market.

Keiths, Limited—Their exhibit consisted largely of electrical fixtures. It was one of the most attractive exhibits of the kind at the fair.

James Morrison Brass Company—Had a varied exhibit of electric fixtures this year as usual. This branch of their business is in charge of Mr. Frank Morrison who has a nation-wide reputation as a producer of original and attractive fixture designs.

The Jones & Moore Electric Company—This exhibit consisted chiefly of a large number of motors in varied sizes. An interesting side-line was their display of Pelouse electric irons, which attracted much attention.

The Stromberg-Carlson Telephone Manufacturing Company—Showed a complete line of telephone apparatus, including automatic key type inter-comm-phone equipment, for use in offices, factories, residences and public buildings; telephones for despatching systems on both electrical and steam railways, mine-a-phones, signal bells, magneto telephones and switchboards for rural line and central energy exchange systems.

The Norton Telephone Company—In addition to the varied telephone equipments shown, a number of lighting fixture and tungsten lamps were also exhibited.

The Canadian Carbon Company—In the transportation building had an interesting display of X-Cell dry batteries, carbon products and electric sundries. A feature of their display was a battery shown in operation under water.

The Toronto Hydro-Electric System—The outstanding feature here was probably the very attractive kitchen shown, in which the many uses to which electrical equipment can be put were attractively demonstrated. In another room a splen-

did display of this equipment was shown, including radiators, stoves, washing-machines, suction-cleaners, etc.

The Holophane Company—No special booth was set aside for this company, but their products were seen, to advantage, in the illumination fixtures of the Toronto Hydro-Electric System and the Toronto Electric Light Company.

The Toronto Electric Light Company—The most interesting feature in this exhibit was the electric dining-room, where the products of electric cooking were so enticingly displayed, that this booth was constantly the centre of attraction. Two other rooms equipped by this company, showed many other household appliances in operation.

R. A. Lister & Company—This firm specializes in gas engines and small electric generating plants. A number of engines were shown in operation, also two small electric plants, suitable for farm use or for large country homes or hotels. A large number of these plants have been installed at different points in Canada.

International Agencies—Showed a varied exhibit of raw and manufactured aluminium.

The Colonial Fixtures, Limited—Showed a varied display of handsome fixtures, in which the colonial design was the most prominent feature.

William Hamilton Company—This company, among other things, exhibited one of their improved Samson water turbines. A card was also distributed giving the wonderful results recently obtained in a Holyoke test, which showed that one of these turbines, operating at an approximate head of 17 ft. at approximately 185 revolutions per minute, had an efficiency, between full gate and half gate, varying from 82 per cent. up to 90 per cent., the highest efficiency being at three-quarter gate.

Airozone Electric Ventilating Company—This firm exhibited their Ozone generating equipment, and distributed literature explaining the value of Ozone as an air purifier in offices, schools, private homes, etc.

The Canadian Independent Telephone Company—The most interesting feature in connection with the exhibit of this company, was the working model of a twenty-five line "presto-phone" switch-board. This board is specially designed for large offices, warehouses, etc. It is of the automatic type of operation, and probably represents the highest degree of cleverness in design and care in construction that the telephone world has seen.

Jones & Glassco—This firm are the sole agents for Canada, for the Hans Renold, Limited, Manchester, and the exhibit consisted chiefly of a working exhibit of a Renold silent chain.

National Electric Heating Company—A special exhibit of irons, toasters, etc., was shown; also an efficient line of heaters and radiators. As indicating the advances being made in electric heating, this firm will shortly install its heating equipment in a Toronto apartment house, where no other source of heating will be obtainable.

The British Aluminium Company—This attractive exhibit indicated the great variety of use to which aluminium is now put. One interesting example shown of its use was a section of the field winding of a motor, which indicated both compactness in design and light weight.

The Macey Sign Company—Exhibited their "American Lens" electric signs, which is said to save 80 per cent. by its efficiency. It is also claimed that these signs can be read three times as far as the ordinary all-lamp type of electric signs.

W. H. Banfield & Sons—Had a very complete display of chandelier chains, in many handsome designs. A number of fixtures were also shown.

The Automatic Electric Cook Company—Exhibited their automatically operated electric stoves and ranges. The automatic control of current used in this equipment is very complete, being such that the temperature can be regulated within a limit of two or three degrees, for an indefinite period.

The Canadian Fairbanks-Morse Company, Limited—Their exhibit of gasoline engines, transmission machinery and mill supplies gave an idea of the large and varied number of lines handled by this firm.

The Tallman Brass & Metal Company—This is one of Hamilton's oldest established industries. For many years they have been large manufacturers of babbit metals. They have just increased their plant for the extensive manufacture of electric fixtures. Their exhibit of fixtures at the fair was in every way worthy of the firm.

The Canada Sanax Company—Exhibited a quantity of medical equipment, prominent among which were the well-known Foen electric hot and cold air producers. Other equipments included an electrically driven vibrator, X-Ray apparatus, etc., etc.

The Crown Electric Manufacturing Company—Had an artistically arranged booth given over entirely to electrical fixtures of very beautiful design.

The Northern Electric & Manufacturing Company—Showed a varied assortment of fire alarm systems, also telephones and telephone accessories and general electric supplies.

McDonald & Willson's exhibit of electric fixtures was the centre of continual interet.

Hot Point Electric Heating Company showed a varied assortment of electric irons, toasters, heaters, etc.

Faircloth & Company had a beautiful exhibit of colored glass-ware and electric fixtures.

Radiant Electric Company—Exhibited a complete line of household equipment and luxuries, including irons, toasters, heaters, foot-warmers, radiators, etc.

Isolated Plant for Halifax

The Acadia Sugar Refining Company, Halifax, N.S., are at present installing a private generating plant including equipment as follows:—3 750-kw. bleeder type turbo-generator units, the electrical characteristics being 3-phase, 600 volts, 7200 alternations, 3600 r.p.m.; 1 11-panel switchboard for the control of the three 750-kw. turbo-generators, exciters, feeders, etc.; and 45 alternating current 60 cycle motors having aggregate horse power of 700.

The above equipment is being supplied by the Canadian Westinghouse Company. Forty-one motors ranging in capacity from 185 h.p. down are also being supplied by the Siemens Company of Canada.

A. G. Marshall, of Ottawa, has been given the contract by the Public Works Department for installing the underground services for the Parliament Buildings, Ottawa, which include the East and West blocks and the Supreme Court. The contract price is $11,995. The specifications of the contract were given in the last issue of the Electrical News. The work is to be rushed to completion without delay.

The Maritime Coal, Railway & Power Company, Limited, recently awarded a contract for a reinforced concrete dam of the Ambursen type to the Ambursen Hydraulic Construction Company, Limited, of Montreal. The dam will be 200 feet long and is to be used for storing water on the Chignecto creek. The storage of water created by this dam is to be used as a condensing pond for the steam generating plant of the company. The steam and electrical equipments being installed at the present time will give more than double the capacity of the original installation. M. A. Sammett of Montreal, is the consulting engineer of the company.

Self-Propelled Railway Passenger Cars

Rapid Development of the Internal-Combustion Type with Both Mechanical and Electrical Transmission

By Mr. S. T. Dodd*

The history of the self-propelled railway passenger cars extends over the last sixty or seventy-five years; indeed from the time the first steam locomotive was developed the thoughts of inventors have turned toward the development of a car in which the motive power and seating compartment would be united in one unit; and experimenters have advocated, and built, a number of different types of such cars.

Steam, compressed air, electric motors driven by storage batteries, and internal combustion engines, have all been advocated as the motive power. Without going into the details of the many different experimental cars built, and the advantages of different types of motive power, we can say that at the present time the advantages of the internal combustion engine in operation, maintenance, and radius of operation are so marked that this article will confine itself wholly to a discussion of the railway passenger car driven by internal combustion engines and a study of its characteristics, maintenance, and cost of operation.

Internal combustion engines have been built which will use fuel in any of its three forms, solid, gaseous or liquid. The use of solid fuel, however, has not as yet been successful, and gas fuels while eminently satisfactory in certain cases are practically prohibited by the conditions of motor car operation. The gas must either be carried compressed in tanks, or manufactured for immediate use in gas producers on the car. These methods, however, limit the operating radius of the car or introduce the same complications which have prevented the success of the steam car and compressed air car.

The use of liquid fuel avoids these limitations. Internal combustion engines using this form of fuel are well known and have proved satisfactory, having reached a high degree of perfection. Liquid fuel offers many advantages in methods of storage and handling, and can be obtained with a much greater heat value, weight for weight, than any other form.

As an illustration of the economy of this type of fuel, it is to be noted that gasoline cars of from 35 to 50 tons in weight, in actual operation in steam line service, are carrying an amount of fuel which is equivalent to a radius of operation of 300 miles, without recharging; and that, including the weight of water for cooling the cylinders, the total weight of fuel and cooling medium does not exceed 2,750 pounds.

As the popularity of the internal combustion engine has been due to gasoline and naphtha, it is to these one naturally resorts for motor cars, and as a consequence, the car we have under consideration is popularly known as the gasoline car. From a historical standpoint the successful application of this type dates from the modern development of the gasoline engine, and is, therefore, comparatively recent. The discussion can consequently be limited to a very few successful types and these can more conveniently be discussed in two groups divided according to the method of transmission of power from the engine to the axle.

(a) Gasoline cars with mechanical transmission to the axle. These will be referred to as mechanical-drive gasoline cars.

(b) Gasoline cars with electric transmission from engine to axle, referred to as electric-drive gasoline cars.

Mechanical Drive

The application of the gasoline engine to light cars for inspection and emergency service is outside of the limits of this discussion and aside from these the best known development for passenger service has been the type of car built by the McKeen Motor Car Company, or the so-called "McKeen Car." The development of this car began in the shops of the Union Pacific R.R. Co., at Omaha, under Mr. W. R. McKeen, Jr., at that time Superintendent of Motive Power of the Union Pacific. The construction of the cars was afterwards transferred to a separate organization which was formed to undertake this work and which became known as the McKeen Motor Car Company. The first of these cars was built in 1905. In its latest development, the standard car consists of a steel body 70 feet in length with center entrance or side doors. In this car the designer has made the side of the car assist the floor beams in strengthening and stiffening the whole structure, making of the car floor and sides a composite girder, while the shape and location of windows and doors are subordinated to the requirements of strength. The exterior of the car, having smooth sides, pointed ends, and a sloping roof, gives the general impression of being suitable for high speed service. The interior of the car is divided into an engine compartment and a seating compartment, either with or without smoker, baggage, or express compartments. The passenger compartment may seat as many as 100 passengers.

The car is carried on double trucks, of which the rear is a four-wheel steel frame trailer truck with 33 in. wheels, and the forward truck under the engine room is a motor truck. This motor truck has one driving axle with wheels 42 in. in diameter to which the power is transmitted from the engine. The gasoline engine which stands on this truck, and swivels with it, is a six-cylinder engine with 10 in. by 12 in. cylinders driving a crank shaft at right angles to the center line of the car. A sprocket is carried on this crank shaft which drives the forward axle through a chain drive by means of an air operated friction clutch. Two gear ratios are supplied and the air clutch throws in the one or the other of these sets of gears, thus obtaining a slow speed and heavy tractive effort for starting, or a high speed for running. With either one of these gear ratios, the variation in speed from minimum to maximum is attained entirely by variation in engine speed regulated by the throttle and spark. With low speed gearing the full engine power is ordinarily attained at about 10 to 15 m.p.h., while with the high speed gearing the full engine power is attained at the maximum running speed of the car. Maximum speeds developed by these cars are reported as high as 60-70 m.p.h. The cars are fitted with fuel tanks of 100 gallons capacity and weigh complete approximately 35 tons.

The manufacturers report that in April, 1913, one hundred and thirty-eight of these cars were in service on fifty different railroads in the United States and foreign countries. The following are some of the typical railroads operating McKeen cars in various parts of the United States; Santa Fe; Buffalo, Rochester & Pittsburg R. R.; Ann Arbor; Virginia & Truckee; Union Pacific; Texas City Terminal; Woodstock & Sycamore Traction Company; Charles

* Railway Engineering and Traction Department, G. E. Co.

City & Western Railway; Norfolk & Southern; Chicago & North-Western; Erie Railroad; Pennsylvania Railroad; Riviera Beach & Western.

In addition to the McKeen cars, some other mechanical-drive passenger cars might be mentioned, although they are less widely in use. Among others the Fairbanks-Morse Company, of Chicago, has built a mechanical-drive gasoline car with single trucks, steel body, and seating capacity of 21 passengers. The P. H. Batten Co., of Chicago, has also built cars of this type with a seating capacity of about 30 passengers, which are in operation on three roads in the Central West. The Stover Motor Car Co., of Freeport, Ill., has supplied small single-truck gasoline cars on the Waterloo, Cedar Falls & Northern Railway, and upon the Chicago, Rock Island & Pacific R. R. The Hall-Scott Motor Co., of Oakland, Cal., has built double-truck cars with a seating capacity of 50, and a 100-h.p., four-cylinder engine driving the rear axle through longitudinal transmission and double gears.

In Europe mechanical-drive gasoline cars have been built by several companies, and either are or have been in use on the Great Northern Railroad (England), the Swiss Federal Railroads, and the Wurtemburg State Railways.

Electric Drive

The fundamental difference between these cars and those discussed in the preceding section is that the engine drives an electric generator, and power is transmitted electrically to motors, geared to the driving axles, instead of the engine being connected directly to the axle by mechanical gearing.

Of this type of car, the most extensive experience has been obtained in this country with the car manufactured by the General Electric Company, which began its design of gas-electric cars several years ago, with the construction of a car for the D. & H. R. R. This car was a standard steam railroad coach, built by the Barney & Smith Car Company, with trucks built by the American Locomotive Company.

The gasoline engine for this car was purchased in England, as at that time there were no suitable engines built in this country to meet motor car requirements. The details of electrical equipment were proportioned upon results of previous experience with heavy railway equipments. After a service of several months covering operation in commercial service of about 5,000 miles, a second car was built, in which the entire equipment was furnished by the General Electric Company, and the design and characteristics were based upon their experience with the first car. The result of this experimental service has been to develop a standard type of gas-electric car which has met with very favorable reception for interurban and branch line service, and to which the following general description applies.

The car body is built of steel and is designed for the combination of the greatest lightness and strength. The front end of the car is rounded to reduce train resistance to a minimum when operating at high speeds. Either center or rear entrance are supplied to meet the requirements of traffic in various localities. The cars are built in lengths running from 40 ft. to 70 ft. overall and weighing from 40 to 50 tons complete. The interior of the car is subdivided into passenger, smoker or second-class, baggage, and engine room. The width of the car is 10 ft. over all, full advantage having been taken of standard steam railroad clearances, and the cars have a seating capacity which may run as high as 95 or 100 passengers per car, depending upon the interior arrangement.

The power plant is located in the engine room at the front end of the car and consists of an eight-cylinder, 550 r.p.m., four-cycle gas engine of the V-type, direct connected to a 100 kw., d.c. generator. The generator is built essentially to meet motor car service and is, therefore, designed to carry a wide range of output in current or voltage, so that the output may be varied from 400 amperes at 250 volts to 125 amperes at 800 volts.

The trucks are of an equalized, swing-bolster type, suitable for the high speeds obtainable with this type of car. One of these trucks is a motor truck, designed for carrying two driving motors. The other is a standard light trailer truck. The motor truck is generally placed under the forward end of the car and carries the weight of the engine room equipment in addition to the motors. In such a case as this, about sixty per cent. of the weight of the car is on the driving wheels. In some cases, however, the motor truck has been placed at the rear end of the car, under the passenger compartment, and in this case, approximately fifty per cent. of the weight of the car is on the drivers.

The car is equipped with two GE-205 100-h.p. railway motors. This is a commutating pole motor and is suited for wide variation in operating voltage. The gearing is specially selected for the service. The gear ratio is low enough that the highest maximum car speed will not develop excessive rotative speed of the armatures; at the same time the ratio is high enough to obtain the requisite starting effort without imposing excessive overloads on the motors.

The car is designed for operation from one end only. The engineer's seat is located at the right hand front window of the engine room, and controller and throttle handles are placed directly in front of him. The controller is a convenient combination of engine and generator control, with the different levers placed vertically above each other and operating about practically the same center line. The highest of these levers is the throttle lever, which controls the supply of gasoline to the engine, and as a consequence the speed and power of the engine. Directly beneath this is the electric control handle. On the first part of the range of this handle the two motors are connected in series, and the whole current of the generator passes through each of them. Successive steps raise the generator voltage from about 250 volts on the first step to about 700 volts on the seventh step. In passing to the next step of the controller, the voltage is reduced to about 250 volts, and at the same time the connection between the motors is changed, putting them in multiple with each other. On the remaining steps the two motors are running in multiple, dividing the generator current between them and each actuated by the full generator voltage. This voltage is raised in successive steps up to a maximum of about 800 volts on the thirteenth step. Two final steps, in addition to this, are suitable for particularly high speeds on level track with shunted motor fields.

The engine generator set is started by admitting compressed air to the cylinders. This is done automatically on the first opening of the throttle. As soon as the engine turns over, and the first charge of gasoline is exploded in the cylinder, the air is automatically shut off.

Air reservoirs are charged and air for the brakes, whistle, and for starting the engine is furnished from an air compressor driven from the main crank shaft of the engine. A small independent engine generator set is supplied for furnishing the lights and a separate compressor connected to this engine is used for charging the reservoirs in case they are entirely empty.

This type of car has demonstrated very marked advantages, and is in operation on a number of steam railroads in various parts of the ocuntry. At the present time 60 of these cars are in regular daily service and some of the roads on which they are in use are shown in the following table.

	Number of Cars in service
Southern Railway	2
Frisco Lines	16

Minn., St. Paul, Rochester & Dubuque Electric Traction Co. (Dan Patch Line)	12
Bangor & Aroostook R.R.	2
Quanah, Acme & Pacific Ry.	1
Missouri & No. Arkansas R.R.	2
Texas Midland R.R.	2
Rock Island Lines	2
Pittsburgh & Lake Erie R.R.	1
Great Northern Railway	2
Chicago, Mil. & St. Paul Ry.	7
Chicago, Peoria & St. Louis	4
Santa Fe	2

In Europe the most extensive experience with electric-drive gasoline cars has been on the Arad-Csanad Ry. in Hungary. This road has been operating gasoline cars since 1905. At the present time they are running approximately 1,000,000 car-miles per annum and have a total record of over 5,000,000 car miles with these cars. Their records of cost of operation and maintenance on such equiments are probably more complete and extensive than any other railroad, and show an average cost of maintenance of 2.5 to 3 cents per car mile. These cars were built by the French Westinghouse Company and recently the same type of car has been introduced into this country, in the car known as the "Dracar," built by the Drake Railway Automotrice Company, of Chicago. This company has already furnished five of these cars for the Missouri-Oklahoma & Gulf Railway Company, and reports orders in hand for a number of other cars. The "Dracar" is 56 ft. long over bumpers and 9 ft. 6 in. in width. The car is divided into first-class, second-class, engine and baggage room compartments, and the general scheme of control and utilization of electrical energy is substantially the same as previously described in connection with the General Electric car.

A few remarks might be in place in this connection upon a type of car which has been tried to some extent and which still seems to find some advocates, that is, the combination of the gasoline-electric car with a storage battery auxiliary. The idea of storing up electricity in a storage battery appears to be so feasible, that the writer finds an insistent inquiry among some engineers for this type of car.

Storage Battery of No Real Value

The fact is that the storage battery is of no real value in combination with the electric drive as it has been developed to-day, and as we have described it above. The real value of the electric drive lies in the possibility of working through a wide range of voltage and current, and the idea of using the storage battery in connection with it is based upon a misconception of the meaning and advantages of the electric drive and is derived from experience with constant potential control. To illustrate, with a self-propelled car having an independent gas-electric drive, if we were forced to keep constant voltage on the generator and, having constant horse-power from the engine, were forced to maintain a constant output of current, it would be absolutely necessary to furnish a storage battery auxiliary. This storage battery would provide the increased current necessary at starting and would absorb the surplus power when running under light conditions. But these are not the conditions which we have with the electric drive as developed to-day. We are not limited to a fixed current from the generator, as the electric generator has the same overload capacity in current as the driving motors. The only fundamental limitation is the horse-power of the engine, and by varying the generator voltage it is possible to obtain the full engine horse-power throughout the whole range of operation, from slow speed and high tractive effort at starting to high speed and low tractive effort at full speed running conditions. Keeping this in mind, it is evident that with the variable voltage control it is possible to obtain the same results from the electric drive alone that would be obtained from constant potential control with the addition of a storage battery. In addition to this, a storage battery has an efficiency of only 40 to 60 per cent. and this loss is entirely eliminated by leaving the battery out. As far as weight is concerned, the same weight of material which would give a kilowatt of continuous capacity in the form of gas engine and generator would only give a kilowatt for one hour if installed in the form of a storage battery. It appears from these facts that with variable voltage control the gas-electric drive gives the same results as the storage battery auxiliary and with greater economy in weight and power.

Comparative Characteristics

Now to compare the characteristics of the mechanical-drive gasoline car with the electric-drive gasoline car, the fundamental difference between them lies in the method of transmission of the power between engine and axle. The comparison of the characteristics is well illustrated in the curves of Fig. 11. These curves show the speed, tractive effort, and gasoline consumption of a car equipped with a

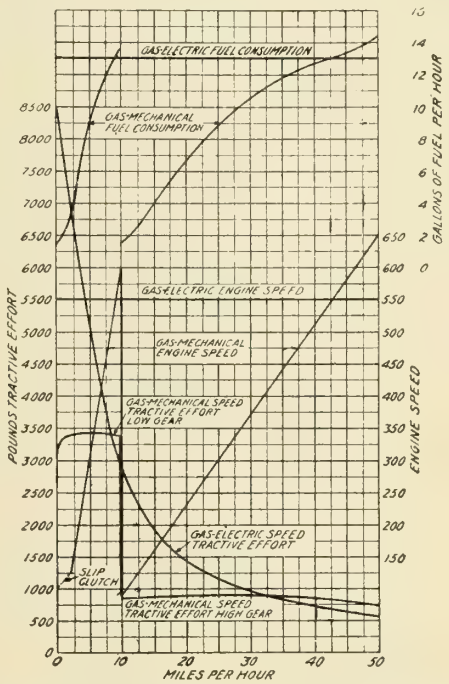


Fig. 1—Curves showing comparative characteristics of mechanical and electric drive.

100 h.p. 550 r.p.m. gasoline engine, driving in the one case, through electrical transmission, the motors geared to 33 in. driving wheels, and in the other case, through mechanical transmission, a single pair of driving wheels 42 in. in diameter. The slow speed gear reduction has been assumed at 7.5 to 1 and the high speed gearing at 1.6 to 1. These conditions correspond approximately to those ordinarily obtained on mechanical-drive gasoline cars of this weight and capacity. The following characteristics can be noted by reference to the curves:

(1) **Engine Speed**—In the electric-drive car the engine speed is independent of the car speed and is maintained at the normal value 550 r.p.m. throughout the whole range of car speed. In the mechanical drive car the engine speed is proportional to the car speed. It starts at a low value with the starting of the car, and increases with the car speed up to 600 revolutions at a car speed of 10 m.p.h. At this point the change gear clutch is thrown in, the engine speed is cut down to 100 r.p.m., with the higher gearing, and is again

raised with the car speed to 650 r.p.m. at a car speed of 50 m.p.h.

(2) **Engine Horse Power**—This is approximately proportional to the engine speed. With the electric drive the horse power is maintained at 100 h.p. throughout the range of car speed, but with the mechanical drive the horse power varies, reaching its maximum value at the maximum speed corresponding to the two gear ratios.

(3) **Tractive Effort at Wheel Rim**—The electric drive, on account of its constant horse power output, develops a tractive effort which varies inversely with the speed. It reaches a maximum of 8,500 pounds at slow speeds, and falls off with increasing speeds at such a rate that at any point the product of speed and tractive effort are constant. The mechanical drive develops a maximum tractive effort of 3,400 pounds up to a car speed of 10 m.p.h. At this point, where the high speed gearing is thrown in, the tractive effort drops to 900 pounds, which is maintained approximately constant through the further range of car speed.

The speed-torque characteristics of the electric drive is very similar to that of the steam locomotive. The maximum tractive effort is limited by the slipping point of the wheels, or by the maximum current which the generator can drive through the motors with the full engine output. That is to say, the current at which the total horse-power of the engine is used up in heating of the motor and wiring will be the limiting current, and the corresponding tractive effort will be the maximum obtainable. General Electric gas-electric cars will in practice develop a maximum tractive effort of 10,000 to 14,000 pounds, depending on the gearing.

(4) **Fuel Consumption**—In the electric drive the fuel consumption is constant, on account of the constant horse-power output. In the mechanical drive the fuel consumption varies with the output of the engine, and, therefore, with the speed of the car, except for the varying efficiency of the engine at different speeds.

Advantages of Electric Drive

The electrical transmission from engine to axle is apparently an added complication, but a number of advantages are claimed for it which largely offset the apparent complication.

These advantages may be briefly stated as follows:— 1. Superior control; 2. Greater reliability; 3. Lower cost of maintenance.

(1) The control is superior to clutches and change gears for the following reasons:

Electric drive is equivalent to an infinite number of speed relations between the engine and car wheels without any change of clutches or gears.

The full engine output may be had at all car speeds.

It permits driving through two or more axles which is a considerable advantage for grade work or slippery rails.

The rigid wheel base of the driving truck may be made short, permitting the use of shorter curves at Y's and turn outs.

Starting and acceleration is made with absolute smoothness.

Accidental conditions can be met, such as hauling of an occasional trailer or the negotiating of a heavy grade, which could not be met if the maximum tractive effort of the car were rigidly fixed by the gear ratio.

The car can be reversed without stopping the engine, an advantage quickly apparent in yard work, switching, coupling, etc.

In case of failure of the brakes, the motors may be used to stop the car.

(2) It possesses greater reliability for the following reasons:

Speed changes are made without shocks to the apparatus.

The engine is mounted on springs on the car body and is not subject to hammer blows when passing over crossing frogs or switches.

It is free from dust and foreign material in the bearings and piping.

Minor defects are easily detected and adjusted before they become serious, due to the accessibility of the engine.

(3) The cost of maintenance is less because:

The apparatus is less subject to shocks, and, therefore, requires fewer renewals.

All parts of the engine are easily accessible.

The location of the apparatus permits making reliable water and gasoline connections and the placing of the radiator on the roof where it is protected from flying stones, etc.

Electric equipment has demonstrated its low cost of maintenance in railway service and the electric railway motor in particular is generally acknowledged to be the most rugged piece of apparatus in railway service.

Fuel and Lubrication

At the present time some of the light distillates of petroleum are the only fuels commercially available for such cars as we are describing. While this fuel has been referred to under the general term "gasoline" the fact is that the quality required is not as high as the product usually demanded and furnished under that name. At the present time, the manufacturer of these cars is co-operating with the refiners of petroleum in making an extensive study of the characteristics and specifications of petroleum distillates which are suitable for engines of the type used on the gas-electric car.

Besides petroleum distillates, there is to be considered the future possibility of the use of other liquid fuels, such as fuel oil or alcohol, but in the present state of development of the art none of these are commercially available.

The whole question of fuel and lubrication of internal combustion engines for motor cars is so extensive and far reaching that it must be dealt with in a separate article.

Inspection and Maintenance

A managing officer contemplating the purchase of motor cars usually asks a number of questions somewhat as follows, each of which we have answered briefly:

What kind of men are required to successfully operate motor cars?

A large percentage of the gas-electric motor cars are being operated by the locomotive engineers who formerly ran the steam locomotives which have been replaced by motor cars. No particular attainments are necessary to run motor cars other than that required for handling any other motive-power equipment.

What kind of training and examination should the men go through to properly qualify for operating motor cars?

It is desirable for railroads, when getting their first cars, to secure the service of an expert operator from the manufacturing company for a limited period, depending upon the circumstances and number of men to be qualified. The operators can best be broken in by starting them in to handle the cars as soon as possible, under the direction of such an instructor. The men, of course, should be provided with an instruction book, and the instructions should follow somewhat the following lines: The men should be made familiar with the names, functions, and location of all apparatus on the car. They should be given a brief general idea of the principles of a gas engine, electric generator, and electric motors. After this they should be given lessons in the proper manipulation of the car, how to run the car with the best fuel and oil economy, and how far the power plant can be pushed without overworking it. They should be taught to notice the forewarnings of trouble, how to locate such trouble, and how to make necessary running repairs and adjust-

ments. Special instructions should be given to the matter of carburetor adjustments and the timing of the engine.

What repair parts should be kept on hand?

It is very desirable to carry a selected list of repair parts. For an amount of between $200 and $300 per car a considerable number of small parts can be secured which will give a large return in insurance against failure. For overhaul parts it will be found that experience in the course of time will tell what it is desired for each particular company to carry, but, as a rule, it is thought that such parts can be anticipated previous to the car being laid up for classified repairs.

Operating Costs

As an illustration of some of the actual operating results obtained with gas-electric motor cars, the following statements are submitted. These figures are selected on account of the number of cars involved and the amount of mileage made.

TABLE I—FRISCO LINES

Cost of Operating Gas-Electric Passenger Motor Cars

Following is a consolidated statement for six months from July 1st, 1912, to December 31st, 1912, covering the direct cost of operation, including classified repairs made during the interval. This includes the performance of fourteen cars operating under varying grade and climatic conditions. Some of these cars were on several different runs.

Revenue motor car-miles	251,627
Revenue trailer car-miles	114,164
Total passenger car-miles	365,791
Per cent. of time trailers hauled	40.3
Gals. fuel (naphtha) used per m.c.m.	.721
Gals. fuel (naphtha) used per p.c.m.	.496

	Total cost for 6 months	Aver. Cost per motor train-mile
Wages of crews	$19,840.96	$0.0788
Fuel (naphtha)	11,857.68	.0471
Lubrication (gas engine)	1,553.28	.0062
Cleaning, supplies and misc. expenses	2,545.91	.0101
Running and shop repairs	7,769.73	.0309
	$43,567.65	$0.1731

The above includes extensive classified repairs given two cars, and all the running and shop repairs on the other cars.

Table II. shows more detailed information on the performance of six of the above cars. They were all on representative assigned runs averaging 166 revenue miles daily; four hauled trailers regularly and each carried a full, motor car, train crew. The actual revenue mileage only is shown, as no allowance is made for turning or other non-revenue mileage. The runs cover varying speeds and grades. The maximum grade, 2.3 per cent., occurs on the Bolivar-Chadwick run, where a trailer is hauled regularly. On this run there is one stretch of 2 per cent. grade for a distance of four miles.

TABLE II.—FRISCO LINES

Cost of Operating Gas-Electric Passenger Motor Cars

Following is a consolidated statement for eight months from July 1st, 1912, to February 28th, 1913, covering the direct cost (no classified repairs made during interval) of cars 2,104, 2,105, 2,106, 2,107, 2,108, 2,109 operating between Muskogee and Westville, Okla.; Dawton, Okla., and Quanah, Tex.; Sherman and Dallas, Tex.; Chadwick and Bolivar, Mo.; Kansas City and Clinton, Mo.; and Clinton and Enid, Okla.

Revenue motor car-miles	181,438
Revenue trailer car-miles	127,605
Total passenger car-miles	308,043
Per cent. of time trailers hauled	70.3%
Average working weight of motor cars	51.5 tons
Average load of motor cars (estimated)	3.5 tons
Average working weight of trailer cars	23.5 tons
Average load of trailer cars (estimated)	2.5 tons
Gross weight motor trains (average)	7.3 tons
Total gross ton-miles	13,296.28
Gallons fuel used per motor train-mile	.751
Gross ton-miles per gal. fuel	97.6

	Total cost for 8 months	Aver. cost per motor train-mile
Wages of crew	$14,417.09	$0.0794
Fuel (naphtha)	8,666.42	.0477
Lubrication (gas engine)	1,356.89	.0075
Cleaning, supplies and misc. expenses	1,586.89	.0088
Running repairs and labor	2,908.46	.0160
Running repairs and material	1,242.28	.0067
	$30,187.63	$0.1661

As an example of the performance on an interurban line with a very fast schedule, Table III. is submitted. The trailers hauled consist of a mixture of passenger, freight and work cars. The cost of heating supplies and maintenance of equipment includes also the cost of these trailers. The longest maximum grade of 1.5 per cent. is about two miles, and one stretch where the grade averages 1.37 per cent. for a distance in excess of four miles. In addition to the station stops, there are two railroad crossings at grade where all trains must stop for the conductor to go ahead and turn crossing gates. The motor cars then pull over the crossing and wait until conductor resets gates. There is also a draw bridge which is not interlocked, where all trains must stop.

TABLE III.—DAN PATCH LINE

Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Company

Cost of Operating Gas-Electric Motor Cars From January 1 to August 31, 1912

Total motor car-miles	216,498
Total trailer car-miles	75,948
Total car-miles	292,446
Per cent. of time trailers hauled	35.5%
Number of motor cars in service	8
Length of line	37.34 miles
Maximum grade	1.5%
Schedule time for express trains	1 hr. 17 min.
Average distance between stops for express trains	3.734 miles
Schedule speed m.p.h. of express trains	29.1 miles
Schedule time for local trains	1 hr. 35 min.
Average distance between flag stops for local trains	1.067 miles
Schedule speed m.p.h. of local trains	23.6
Gals. fuel used per motor train-miles	.758
Gals. fuel used per car-mile	.527

	Total cost for 1 year	Aver. cost per motor train-mile	Aver. cost per car-mile
Wages of crew	$12,056.95	$0.0557	$0.0412
Fuel (naphtha)	17,622.26	.0814	.0603
Lubrication (gas engine)	1,141.56	.0052	.0039
Journal oil	77.77	.0004	.0003
Supplies and car heating	1,389.03	.0064	.0047
Maintenance of electric equipment	1,949.81	.0090	.0067
Maintenance of cars and trucks	1,394.56	.0065	.0047
Shop expense and heating	3,507.77	.0162	.0120
	$39,139.71	$0.1808	$0.1338

The Accounting of Public Utilities

A paper presented by H. A. Robson, Public Utilities Commissioner for Manitoba, before the Eleventh Annual Meeting of the Dominion Association of Chartered Accountants

The expression "Public Utility," for present purposes, may be taken to refer to undertakings instituted to serve the public in such matters as transportation of either passengers or freight; the means of communication by telegraph or telephone; the production and furnishing of water, gas, heat, light or power.

These public needs have in the past largely been met by private corporate enterprise, but the attractive idea that the people should establish and operate for their own benefit their public service equipments has so taken hold that the field has become divided, and now frequently we find public utilities in the hands of the people's representatives, either municipal or parliamentary, in some cases being in competition with the private corporation.

No matter whether publicly or privately owned or operated, these indispensable adjuncts to modern industrial, commercial and domestic life are "public utilities," and, generally speaking, subject to the same control and regulation. Laws providing such control and regulation, and establishing public utility commissions to apply the same, are being gradually extended throughout the United States. In Canada the idea has taken root and will grow. To select for control and regulation this class of private corporation as distinguished from other mercantile institutions is quite logical, when it is considered that a public franchise, usually granted for a long term, perhaps in perpetuity, and almost invariably gratis or on favorable terms, is the foundation on which the undertaking rests. Such a franchise may mean the right to use the most valuable thoroughfares of a large city for tramway purposes, the right to dig up streets and install conduits and pipes, or to encumber highways with lines of poles and wires for purposes of communication, or for the conveying and distribution of a dangerous force. It has been said that such a franchise is but a part of the power or privilege of sovereignty allotted to a private person for the benefit of all, and only incidentally given for private emoluments. This delegation of sovereignty is even more conspicuous when the right of expropriation of private property is given, as to many utilities, and always to through railroads is indispensable. Such is the unquestionable justification of the control and regulation of franchise corporations; and when the questions are put: "Why should any private corporation be required to render accounts to a public authority?" "Why should the private corporation be required to follow a system prescribed by such authority?" the palpable answer is that the sovereign people are entitled to demand that it shall be disclosed, to authority established for the purpose, what benefits are resulting from the delegation of the public franchise to private interests.

Commissioner Maltbie, of the New York Public Service Commission, in dealing with the subject officially, said:—

"It has been urged by some that the public, the consumer, the taxpayer, the citizen and the public official, is not entitled to prescribe accounting systems for corporations or to know about its financial affairs. The theory has been exploded, and it is sufficient to recall the facts that public service corporations have been granted certain very valuable and special rights by the state and local authorities which individuals and corporations generally do not possess, that these corporations are using the streets and public places—the property of the public, that the public is therefore in a sense a partner in the enterprise, and as such is clearly entitled to know what the firm is doing; that many corporations have a virtual monopoly; and that, having tried a policy of non-interference, experience has shown that the welfare of the individual, of the city, and of the state is not adequately protected without regulation and control."

Hence in advanced jurisdictions, public utility corporations are subjected to a special tribunal, namely, the Commission, whose jurisdiction enables it to control rates, to exact extended or improved service, and to decide questions on all matters arising between the Utility and a Municipality or private citizen, and of equal or paramount importance to impose a system of accounting and periodical report of financial results.

For practical purposes there are a variety of reasons for such accounting. Many of the provisions of public utility Acts are passed in the interest of shareholders, bondholders and mortgagees, in whose interest it is that there shall be supervision of accounts, and particularly that there be a due regard to depreciation, and by providing for depreciation, funds or reserves, ensure that capital is not impaired to make up dividends. The prominent instance of reference to such accounts is in rate questions to see if present traffic and the resulting revenues are such that reduction of rates may be ordered and still leave a fair return on the investment. The right to increase rates will conversely depend on the accounts showing that present traffic and rates do not produce such fair return. Improvements of service and extensions of plant and distribution equipment are frequently demanded. Here the financial capacity of the utility is a consideration, and an inquiry thereupon is an essential proceeding. Properly kept accounts duly reported to a Commission answer the questions at once. In highly profitable franchises where rate reduction for some reason may not be possible, as in the case of fixed rates of street car fare, there is the alternative course, frequently even more satisfactory, of requiring extended or improved service. All this is done in a spirit of the utmost fairness to the corporation. I again take the liberty of quoting from the invaluable opinion of Commissioner Maltbie. He said in this connection:—

An Invaluable Opinion

"An important reason for the general approval of highly differentiated forms of accounts is that they serve to protect and profit the thrifty and honest corporations. It is not the purpose of public regulation by reducing rates to take from a corporation all of the proceeds of enterprise and thrift that it may earn beyond a reasonable dividend. If a thrifty and intelligent corporation can, at a smaller expense to itself, supply a better public service than a careless and incompetent corporation, the former should not be compelled to charge the public less than the latter. To do so is to discourage progress and economy. The systems of accounts reported will show what corporations exercise care, economy and ingenuity in operation and good judgment in the selection of employees. Present obscure and varying methods of keeping accounts furnish no basis of comparison, and a tendency is to put the thrifty and unthrifty in the same class and seek to deprive the stockholders of the thrifty corporation of their fair rewards."

Proper accounting by such utilities is necessary in their own interests. Without a reliable system by which at any moment they can exhibit their financial burdens and gains they cannot meet attacks that may be made with only apparent justification. One of the chief benefits to be derived

from the standardizing of accounts is the possibility of comparing conditions in different places. Incidentally may be mentioned the power of a commission to require at any time an independent valuation or appraisal of a utility plant. This valuation provision is necessary in settling rate problems, the actual value of the plant and equipment, with cost of operation, being the true basis of rates. The valuation and accounting provisions are indispensable towards the supervision by the Commission of the issue by a utility of new stocks and bonds for which the consent of the Commission is required. Such, in a few words, are the salient purposes of accounting in the case of private franchise corporations. What about the like accounting by publicly owned utilities, by which are meant municipal undertakings? Does the necessity for public accounting exist? It does, for some of the reasons mentioned, but also for others. It is necessary to consider for a moment the special nature of such enterprises. The end to be gained by the pledging of the public credit for the installation of public utility plants is not always the same. Water service now naturally falls in this country to municipal authorities. That cannot yet be said regarding electric or gas plants, telephones, telegraphs, railways or tramways. There are increasing instances of publicly owned and operated electric and gas plants, telephones and street railways. These may be instituted from different motives. It may be that the field is new and private enterprise not at hand, or that reduced price of service is sought to be secured by means of public competition, or that existing private undertakings do not cover the field, and public action is imperative or is thought to be beneficial to the community.

Not Intended to Make Profits

It seems to be the intention in this country that these publicly owned plants shall not be expected to do much, if anything, in the way of making profits; this is so that the consumer may get service at cost. But equally well founded is the determination that such plants shall, when well-going, be made to pay their way and cast no burden on general taxation. Both private and public utility enterprises have their early periods of operating loss, while attaching business. Consideration must be given to this. In some municipal cases this loss may continue till the community increases in population, in which increase the very existence of the utility service in the community may be a factor. But allowing for all this, the desired financial end is that the utility shall be self-supporting. A municipal plant run at a loss means that taxpayers who do not use it, though they may remotely benefit from the fact that the plant is there, are paying for the service provided to their neighbor and not to them. In public plants there are no shareholders to be concerned. Bondholders have the whole assessable property to fall back on and so may not feel much interested in the finances of the plant. Questions of rate reduction are not likely to arise; so that the reasons for requiring accounting in public plants are not identical with those in private ones. Yet it is all-important that there be independent supervision of the accounting of publicly owned utilities and the enforcement of adherence to proper principles, and that this be likewise made the means of acquainting the taxpayers with what is being done with their money, and with the funds raised on the security of their property, and whether the administration is successful, and the financial result of the undertaking satisfactory. Every taxpayer is under a guarantee limited by the value of the property he owns for the debts of the municipal utility. He is entitled to know reliably the extent to which such guarantee is by reason of deficits converted into direct liability, and to know what the taxpayers in the municipality are paying for the privilege of having the utility. In municipal cases depreciation reserves are of the highest importance, else the present may be consuming the plant at the expense of the future. In cases where there is competition between a public plant and a private one it is but just that the same rules of accounting should apply to both. The principles of accounting are of course the same in both classes of utilities, but the leaning of the administrative bodies as to certain accounts may in one class be in a quite different direction to those in the other; so it has come about that in the case of a general public utility law municipal enterprises are subject to that law and to the same jurisdiction. This is expressly required in the Manitoba Act, which contains the provision that every municipality operating any form of public utility service shall keep the accounts thereof in the manner prescribed by the Commission for the accounting of similar public utilities, and shall file with the said Commission such statements thereof as it may be directed to do by the Commission. The simplicity of application and enforcement of the law in case of private corporations may not exist in the case of publicly owned utilities, but publicity and willingness to submit to authority invariably overcome impediments of that sort.

It is enlightening to observe the experience of a long-established Commission with the accounting by municipal utility managers. Chairman Roemer, of the Wisconsin Commission, in a public address, expressed himself thus:—

"The system of accounting prescribed by the Commission has for its basic principle such classification as will enable the ascertainment of the cost of service. Although it is self-evident that no business of such character can be successfully conducted without an accurate knowledge of the cost of rendering the service in which the utility is engaged, it was surprising to learn that while the best conducted privately owned utilities had in a measure recognized the importance of such information and had somewhat imperfectly attempted to ascertain the same, the majority of the managers of municipal plants had generally been wholly oblivious to the necessity of any such knowledge. . . . .

"Accounts pertaining to municipal plants were often merged with other accounts of municipalities, and even where separation was made the accounting was so crude and inaccurate that it was impossible to ascertain therefrom even approximately the cost of any class of service. In this connection, it may be said that the system of accounting prescribed by the Commission, although differing from that heretofore generally in vogue, has met with general approval among managers of privately owned plants, and those in charge of municipal plants who have endeavored to administer the affairs of the plant upon a sound business basis. . . . .

"Installation of a system of bookkeeping to conform with the prescribed accounts of the Commission has been necessarily a somewhat difficult task, especially in the case of municipal plants. Many of the smaller utilities, which had hitherto evidently not seen the necessity of recording their transactions in a businesslike manner, have taken time to adjust their books to the accounting requirements.

"The local authorities in control of municipal utilities were at first slow to respond to the demands of the Commission, except in the most progressive communities. In some instances it appeared that those in charge of such plants were apprehensive that proper methods of accounting might result in disclosures reflecting upon the capacity or integrity of the management. In other instances, there seemed to be no one in the organization of employees capable of keeping a set of books intelligently. This was particularly true where the management changed with the municipal administration. However, in practically every community where the management was entrusted to a non-partisan board whose personnel was more or less permanent, there was no difficulty in securing hearty co-operation in putting into effect the prescribed system of accounting. Such boards were quick to recognize the benefits that would be derived from a uniform system of accounting. As the various plants are classified according to

size, comparison of results of operation between plants in the same class has proven of inestimable value to the managements of all plants, whether publicly or privately owned."

I proceed, therefore, with the consideration of this legislation as affecting both publicly and privately owned plants. The prominent type of the Acts respecting public utilities requires that each utility shall "keep its books, records and accounts so as to afford an intelligent understanding of the conduct of its business, and to that end that the Commission may require every such public utility of the same class to adopt a uniform system of accounting, which system may be prescribed by the Commission," and to "furnish periodically and whenever the Commission shall require a detailed report of finances and operations, in such form and containing such matters and verified in such manner as the Commission may from time to time by order prescribe."

What Canadian provinces have done

Such are the Manitoba provisions adopted from those of one of the United States. Of Canadian laws the Nova Scotia Public Utilities Act bears the closest resemblance. New Brunswick and Quebec have Public Utility Acts, but they omit those provisions of the now standard Public Utility law. The Act respecting the Ontario Railway and Municipal Board contains many Public Utility Act features, but lacks the accounting provisions. The Ontario Power Commission Act authorizes a uniform system and the regulation of bookkeeping in municipal plants. In Saskatchewan it would appear that the telephone utility is the only one dealt with in this way so far. In that province municipalities operating telephone systems are required to keep accounts thereof distinct from the general municipal accounting, and companies operating rural telephones are to keep accounts in form prescribed under statute. Accounting provisions are, of course, common in English general Acts respecting public utilities, such as railway, gas, water, and electric services, but it is safe to say that the definition of principles and close inspection by public authority have been brought to most advanced stages in Public Utility Acts. The provisions just mentioned are similar to the accounting legislation found in the Dominion and Provincial Railway Acts. These are content with requiring accounts to be kept and balanced periodically. Certain returns to the Minister of Railways in prescribed form are also required. But this does not introduce any uniformity of system of internal regulation or lay down any accounting principles or rules to be observed. There is conspicuously present the opportunity for elasticity of bookkeeping which it is the principle of Public Utility Acts to avoid. The outstanding feature of accounting under such acts is, as has been decided, and accepted without question, that the power to require a uniform system of accounting includes not merely the enumeration of the titles of the accounts, but also specific provision as to the method of keeping these accounts, the definition of terms used, and a statement of how various items shall be debited and credited; in short, in the system as it has developed where it is of longer growth it does not depend on the ideas of the financial management of a concern what shall be charged to capital and what to operating, what reserve shall be established, or what specific records shall be kept. The Commission, under the law, by a complete accounting code, prescribes all this. The utility is left free to establish such sub-accounts as it sees fit in its own particular circumstances, but that is the only latitude afforded to it.

The subject has been an absorbing one in various jurisdictions. It was found to be so important in New York that over a year was consumed in the consideration of the matter, accompanied by conferences between the two Public Service Commissions of that State, representatives of the Interstate Commerce Commission, other Public Service Commissions and Associations representing the various classes of corporations. Public hearings were held and various methods and suggestions submitted and considered before a definite scheme was reached. Even this was guarded by an expression that changes might result, as experience indicated possible improvement.

The system adopted as a result of the investigations mentioned, and brought up to date in the various states which have developed this law, is largely the result of the combined judgment of engineers and accountants, and is a monument to the high skill and intelligence of the authors. Thus the opinions of these professional men became crystallized into law. While it now appears in written form, just as does the common law in its repositories, it is nevertheless a common law derived from the sense of truth and right of those most qualified to declare it.

Accounting methods of utilities are not subject to any differing standards merely by reason of the fact that public act may be in force. Sound accounting is the same everywhere. There may be slight differences in detail in the rules laid down by different commissions, and questions may arise as to the applicability of rules to cases, but true principles are not affected by mere locality or by the existence of a jurisdiction. Under the public utility act sound accounting becomes law, where elsewhere it would be a business or moral standard without means of enforcement by law.

Division into Classes

It would take this paper to unreasonable lengths to enter into the different phases of the accounting processes defined for the various utilities. A few words by way of illustration must suffice. Certain rules are fixed by the law itself, viz., that the utility shall not capitalize any franchise to be a corporation or capitalize any franchise in excess of the amount actually paid to governmental authority therefor, or capitalize any contract for consolidation, merger or lease. Otherwise the accounting field is left to the discretion of the Commission, with the special expression that the Commission may by order require a proper and adequate depreciation account in accordance with such rules as the Commission may prescribe, and that the Commission may fix proper and adequate rates of depreciation.

It was obviously difficult for the Commission to frame a single system of accounting, going sufficiently into the details of the large companies or municipalities, and yet suitable to the limited operations of the small ones. This was met by prescribing certain classes. For instance, utilities were in Wisconsin given two classes, Class "A" being for utilities operating in municipalities of 10,000 population and over Class "B," for those operating in municipalities under that figure. Any utility in Class "B" which desired a more detailed classification might open the accounts prescribed for Class "A," and any utility in Class "A" desiring a more detailed system might go into as much sub-division and refinement of each of the submitted accounts as its interest required, but was not allowed to rearrange or combine any two or more of the accounts in such a manner as to interfere with the integrity of the general scheme, and so destroy the possibility for comparisons. In some of the jurisdictions the classification is based upon the amount of the revenue of the utility, the division points being fixed at such figures as $500,000 and $100,000, but all the accounts being so arranged under such main headings that the transition from the smaller to the larger is easily effected.

Features to be attained under this control and regulation of accounts include the due charging in each year's accounts of the due and proper portion of fixed capital consumed in that year, so as to ensure that a sufficient amount will be expended or set aside to keep the property up to the proper standard, and, on the other hand, that an undue amount is not taken out of earnings to be spent on the plant, and thereby form a concealed reserve; the establishment of deprecia-

tion provisions arrived at on reasonable estimates and the observances of the fine distinctions that pervade that subject, the disposition of overhead charges and expenditures on what are termed intangible assets, and various other phases of more or less importance. These provisions have been defined in elaborate codes drawn to suit the various utilities and the different classes of each. They were, as stated, evidently based on the combined experience of accountants and engineers, who had specialized upon the work. The Commissions have always for such purposes the advantage of a competent expert staff, or are by law enabled to resort to such assistance whenever occasion requires.

The observance of a code so framed will not be found oppressive, and will not only meet the public demand involved, but will repay the utility itself by introducing method and enabling the owners, whether public or private, to be quickly and accurately informed of their position at any time. It needs no demonstration that it will be beneficial to an electrical utility, for instance, to so classify its income account as to show separately its revenues from Commercial light, Municipal light, Commercial power, Municipal power, and its non-operating revenues, and to classify operating expense accounts, such as power, transmission, storage, distribution, commercial, salaries, rents, etc., contribution to depreciation reserve, taxes, interest on funded and other debts, sinking fund requirements, etc., and that its balance sheet accounts shall contain account for intangible capital such as organization, franchises and plant equipment, transmission and distribution systems, general office equipment, stores, expenditures during construction, reserve accounts for depreciation, sinking funds, amortization, maintenance and uncollectable accounts, current assets accounts, accounts of capital liabilities, mortgage liabilities, current liabilities and accrued liabilities, the whole being according to detailed direction, of easy comprehension and application, as to what shall or shall not be included in any account.

I bring this paper to a conclusion, believing that you will agree with me that the case is made for the accounting of public authority in respect of both private and municipal utility concerns. Our country being newer, the need in the public interest of the regulation and control of franchise companies has not become impressed on us as it has upon our neighbors ot the south. There, strongly intrenched interests held franchises of long standing, cheaply obtained and perpetual or virtually so, and now become of inestimable value. The public service law was the remedy for abuses or neglect. The eager desire to secure the introduction of a utility may induce the grant of a franchise without due consideration of its potential value. That such has occurred in Canada need not be said. It is inevitable that measures of just regulation and control shall become general here as in the neighboring states.

The important part to be played by the accounting profession is obvious. The public utility laws have made that profession part of the system. The Commissions have recognized and declared to these utility enterprises that the skilled accountant is indispensable to them for their own welfare. But there is a responsibility, and it is a heavy one. It is that the Commission and the public are entitled to know without the slightest suggestion of doubt that the accounting results furnished and certified by any chartered accountant on behalf of a utility are the result of the intelligence, accuracy and fidelity which characterizes the profession. The accounting profession is thus expanding in its public importance and responsibility.

The science of accounting developed with commerce. Invention and discovery produced immense growth of industrial enterprise. The vast capital employed in mammoth undertakings, both public and private, brought with it complexity of financing, and inevitably required as its indispensable adjunct an accounting profession of infallible skill and reliability, and this not only to institute and preserve its memorials, but to guide and often restrain constructive genius and courage.

And so your profession, ever ready, keeps pace with the march of progress, until now we find it taking essential part in functions of government. It may be either in the regulation of the exercise of a franchise granted by the sovereign power or in the administration of the people's undertakings. In whichever it be, your profession will maintain its traditions and fully reward the confidence now so amply reposed in it.

Personal

Mr. H. C. F. Poste, formerly superintendent of the Canadian Light and Power Company, at St. Timothee, P.Q., has been appointed superintendent of the entire system of the company.

Mr. D. W. Smith, lately with The Westinghouse Electric & Manufacturing Company, has associated himself with The Robbins & Myers Company in the position of Manager of Motor Sales.

Mr. Geo. L. Hatheway who formerly travelled a portion of Canada, and New York state for Pass & Seymour, Inc., is now spending all of his time in Canada in the interests of this company. Mr. Hatheway was formerly manager of sales of the Fullerton Electric Company, of New York. He expects to permanently locate in Canada, and will probably maintain an office in Toronto.

Mr. R. G. Black has been appointed by the Ontario government as their representative on the Toronto Hydro-electric Commission, a position vacated some time ago by Mr. H. L. Drayton. This Commission consists of three members, composed as follows:—Mr. P. W. Ellis, Chairman, appointed by the city of Toronto; Mayor Hocken, member ex-officio; and Mr. Black, the government's appointee. Mr. Black's appointment will meet with universal approval.



Mrs. Lena Williams.

Mr. H. A. Worby, manager of the Westbury Electric Light & Power Company, Cookshire, P.Q., is particularly fortunate in his choice of operators. For the last year and a half his daughter, Mrs. Lena Williams, has taken complete charge of one shift each day with perfect satisfaction to the owner of the plant, as well as to the customers. We believe this is the only case in Canada of a lady operator of a light and power plant. Mrs. Williams, whose photo is reproduced herewith, is the wife of Mr. Elmer Williams, power electrician of the Westbury plant.

An interesting book has just been issued under the auspices of the city council of Hamilton, Ont., which outlines the history, commerce, industries, and resources of that city. The book is handsomely bound in stiff linen covers, and splendidly illustrated and printed.

The preface states that thanks for the preparation of this book are due to Mr. H. M. Marsh, Commissioner of Industries; Mr. T. L. Brown, Secretary of Board of Trade; Mr. A. F. Macallum, City Engineer; Mr. W. E. Carey, Financial Agent; Dr. James Roberts, Medical Health Officer; Mr. E. I. Sifton, Chief Engineer of the Hamilton Hydro-electric system; Alex. Metherell, real estate broker, and others.

Testing of Telephone and Telegraph Lines*

A Series of Short Articles Based on the Author's Practical Knowledge and Experience—Applicable to Plant of Any Size or to Any Manufacturer's Equipment

By Mr. T. H. Nicholson

There are a large number of standard arrangements of the Wheatstone bridge that have been evolved from time to time by different manufacturers, and as required for different purposes. These can all be made to serve our purpose by more or less extended manipulation, but, owing to the frequent use demanded of them in telephone service, the one needing the least preparation, and the least amount of calculation after a balance has been obtained, is evidently the one to be desired.

The three bridges here shown are typical of those in general use in this country, for use where a simplified ohmmeter or direct reading faultfinder is not accurate enough for the class of testing in hand, especially on long distance lines.

Fig. 7 shows the connection of the Post Office type of bridge which although it has some objectionable features, as before explained, is very easy to operate, and in addition has the advantage of being comparatively cheap, owing to the small number of coils and contacts required. In this instrument advantage is taken of the fact that with the figures 1-2-3-4 any number from 1 to 9 (or if necessary 1 to 10) can be obtained, so it is only necessary to have four sets of four coils each for the complete rheostat or "R" arm.

In the illustration it will be noted that the plugs have been removed from the 1, 3 and 4 units, the 2 and 3 tens,

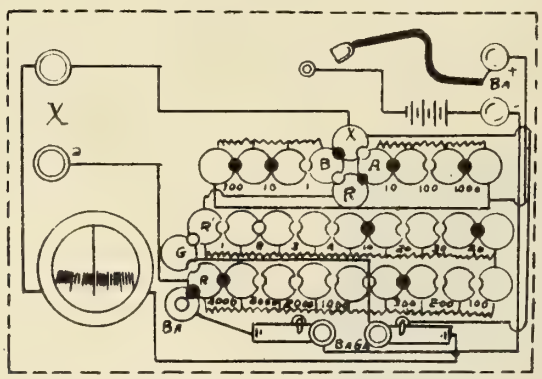


Fig. 7—Diagram of connections, Post Office Wheatstone Bridge.

the 1, 2 and 4 hundreds and the 1, 2 and 3 thousands. These all added together in three respective values will give the value of the rheostat adjustment, which is 6,758. The A and B arms are implugged at 100 and 1 respectively, so that from the rule, the resistance indicated must be 675,800 ohms.

The trouble often experienced with the plugs from poor contact, and the constant uncertainty as to their condition when testing, together with the necessity of adding up the unplugged coils to get results, led to the deveolpment of the decade type of bridge which is shown in Fig. 8.

In this instrument the rheostat is arranged in decades, that is—the units, tens, hundreds, and thousands have each a complete set of coils from 1 to 9, and with an arrangement of busbars, or common contacts, all in series, any one coil in each decade can be connected into circuits. Only one plug can be used in each decade, as any other plugs would simply put the coils affected in multiple with the rest in that decade. When a balance has been obtained it is only necessary to read across the decades, using the plugged units to find the value, which in the figure is 6,190. The relation of this to the "X" resistance, as in other bridges, then depends on the relation of the A to B arms.

When the necessity for frequent testing of telephone lines came to be realized, and the possibility of close location of line troubles appreciated, it was seen that a further im-

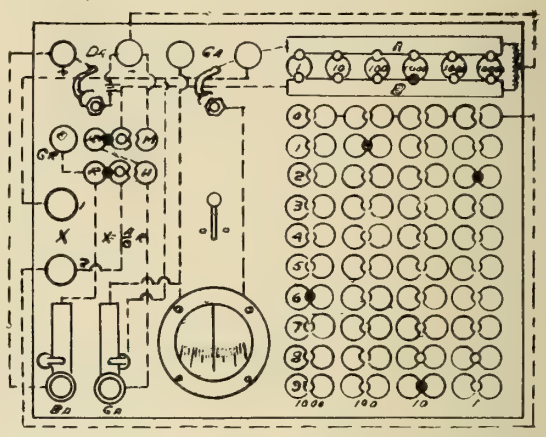


Fig. 8—Circuits of Decade type of Wheatstone Bridge.

provement could be effected by avoiding the plugs in bridges altogether. This resulted in the Dial-Decade type of bridge shown in Fig. 9, which is the latest development in this instrument for ordinary testing.

Each of the dials has a sliding pointer which makes contact with one terminal of a coil in a manner similar to that followed with a plug decade bridge, with the advantage that the dial can be adjusted easier and quicker than the plugs. The method of reading is of course just the same.

In the first instruments of this type some trouble was ex-

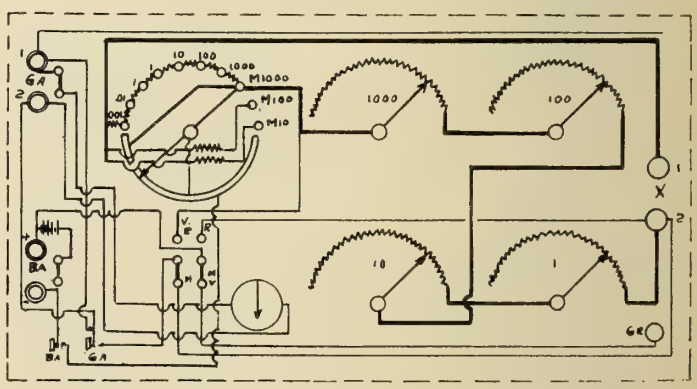


Fig. 9—Circuit and arrangement of Dial-decade type.

perienced with the contacts becoming dirty or weak, but further development has solved most of these difficulties, especially in some makes where the contacts are mounted inside the case, only the index pointers appearing on top, so that it is possible to obtain an instrument as nearly perfect as can be reasonably expected.

The bridge shown in Fig. 9 also includes another improvement that was made possible with dial manipulation. This is the use of a dial controlling the A and B arms so arranged that the multiplier is indicated directly on each setting.

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Electric Railways

Saskatoon's Track Construction

The sketch herewith illustrates the type of track construction used on Saskatoon's municipal system. On paved streets the 85-pound high T rail is used with 8 feet by 8 inch by 6 inch ties, two foot centers, with five inches of solid concrete under ties, and filled with concrete to a two-inch crowning. The groove for the wheel flange consists of a strong mixture of concrete with wire reinforcing six inches wide, which makes a very strong job. The radius of curves ranges from 55 feet to 225 feet of heavy steel. Skeleton track work on the unpaved portions of the system

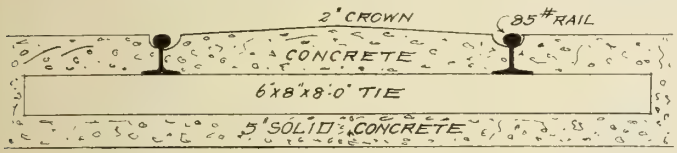


Diagram showing track construction, Saskatoon

consists of 60-lb. steel, ties 20 inch centers, with 6 inches of good gravel under ties, bonded with 32 inch pressed bond, under continuous rail joints. This skeleton track is crowned under centre to top of tie with gravel, with a decided drop from centre to end of ties on either side to allow water to drain off. Mr. Edward Hanson is superintendent of Saskatoon's street railway system, adding these duties to those of city electrical engineer.

Track Construction on the W. E. Ry. system

The accompanying line drawing represents a cross-section of the standard construction work on paved streets of the city of Winnipeg. A 7-inch T-rail, Lorain section, 80-335, is used with 6-inch stone setts placed longitudinally along both sides of the rail and asphalt pavement in between. The company consider the T rail to be the best construction for maintenance, also for vehicular traffic, as it enables heavily loaded vehicles to turn out of the flange-ways easily.

On the sub-grade the figure shows that the company put in a 4-inch earthenware weeping tile drain under the centre of each track. This is found necessary owing to the extreme flatness of the city of Winnipeg which is very difficult to drain. All the weeping drains are laid to grade and connected to sewers.

The sub-grade consists of 3 inches of broken stone which is rolled until thoroughly consolidated. On top of the broken stone is placed 6 inches of concrete under the ties and the concrete is continued 1-inch above the ties to receive the stone setts. When the stone setts are placed and set there is put on what is called the top concrete, to the under side of the asphalt pavement, which is about 3 inches thick. It will be seen from the figure that the track is not crowned.

The cross-section, with dimensions, of the rail used, is shown to the right of the figures. Continuous rail joints are in use throughout.

Chicago Railway New Cars

The final plans for 200 new cars for the Chicago Railway Company have been completed and the contracts let. They are to be built, 50 by the American Car Company, 50 by the Southern Car Company, and 100 by the company itself in their 40th avenue shops. The first deliveries from the builders are expected by the middle of October.

These cars are to be of the arch-roof type of construction with the lines of the car practically the same as the standard car now in use. Considerable effort has been expended to keep the weight down with the result that it will probably not exceed 37,000 lbs. All-steel underframes are to be used and will be built by the American Bridge Company for all 200 cars. The underframe weighs approximately 4,000 lbs. The side girders, as shown in detail in the accompanying drawing, are made up of a 30-in. plate of No. 12 gauge steel which extends up to the window rails and forms the outside panel of the car. This feature aided materially in reducing the weight. The bolster will have a steel casting and be so designed as to give adequate strength with comparatively light weight.

The new cars are to be built for double end operation with the platform arrangement practically the same as that on the older cars. The total car length will be 48 ft. 5 ins. and the platforms are 8 ft. long. The heights of the steps have been lowered quite materially and will be 12½ ins., 11 ins., and 10 ins. respectively as one enters the car, and there will also be a ramp from the end sill to the bolster of 2½ ins. in 5 ft. The floor will be 36 ins. above the rail at the bolster and 33½ ins. at the end sill. The front exit step will be arranged to fold up with the door mechanism. The seating capacity of the interior of the car has been increased from 40 to 48 and in addition folding seats will be

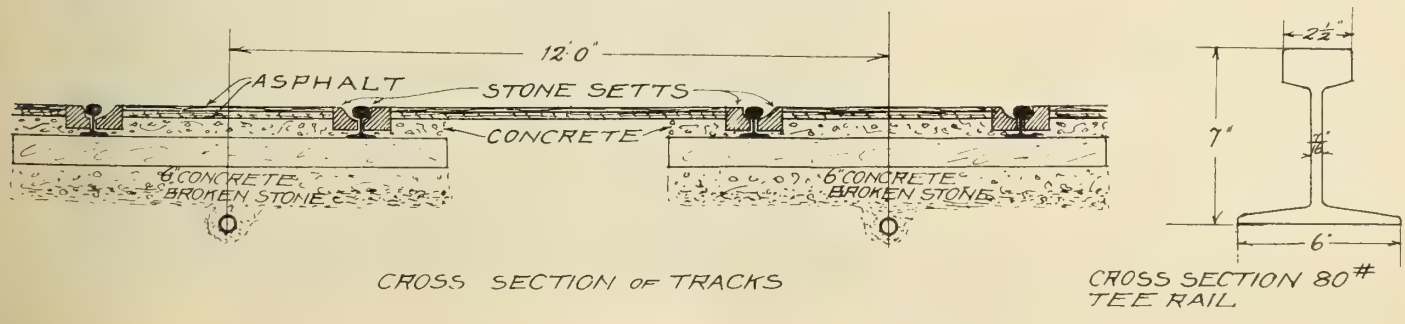
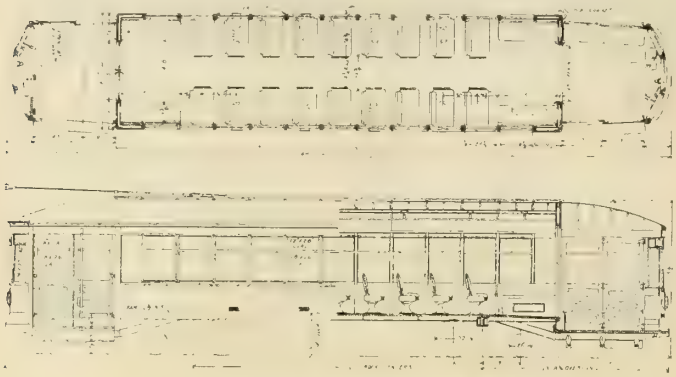


Diagram showing track construction, Winnipeg

provided on the front platform which accommodate five passengers, making the total seating capacity 53. This is a 32½ per cent. increase of the interior capacity. The interior of the car will be finished in cherry and rattan seats used.

The Brill 39-E trucks are to be used with a 32-in. driver wheel and a 21-in. pilot wheel. Two Westinghouse fully ventilated field control motors No. 534 Y-1 of the box type will be used on each car with a 15-69 gear ratio and 3 pitch gears. The brake equipment will be supplied by the National Brake Company. The cars are to be ventilated by the Cooke system and the air intake is to be made through louvres in the side of the car instead of the floor, thus eliminating the dust trouble to some extent. The new cars are expected to make a saving in energy consumption per car of not less than 25 per cent.



Plan and side elevation—Chicago's New Cars

The new car has been designed by the equipment department of the company, under the direction of Mr. H. H. Adams, superintendent of equipment.

Miscellaneous Trade Notes

The Sterling Telephone & Electric Company, Limited, 200 Upper Thames Street, London, E.C., England, announce that at the end of September they will remove to more commodious premises situated at 209-212 Tottenham Court Road, London, W.C., England.

On August 9th the city of Springfield, Ohio, witnessed a parade of the employees of the Robbins & Meyers Company which was quite above the ordinary and was one of the most interesting demonstrations of industrial strength that that city ever witnessed. The event was the annual picnic of the employees of that company.

On September 1st the Lancashire Dynamo & Motor Company moved to new premises at 107-109 Duke Street, Toronto, where they have greatly increased facilities for the handling of stock, thus preventing delays in shipment hitherto unavoidable. The company are also greatly enlarging their stock and will be able to meet orders promptly.

Mr. Edson O. Sessions announces that he has opened a new office in the Marquette Building, Chicago, where he will carry on the business of consulting engineer. Mr. Sessions' experience comprises over twenty years service in construction and engineering work. He is a fellow of the A. I. E. E., a member of the A. S. M. E., an associate of the A. S. C. E., and a member of the I. E. S.

The Ohio Brass Company announce that they are now manufacturing all-wire rail bonds with pin driven terminals. All types and forms of this company's bonds, which have been furnished with compressed terminals, are now furnished in addition with the pin-driven terminals. The new bonds have embodied in them the same features which have characterized the older types, namely, terminals and body made of the same strands and the strands protected by thin copper sleeves at the point where they are welded together to form the terminal.

Mr. Herbert Berry, of Messrs. Berry, Skinner & Company, London, Eng., is paying his first visit to Canada. His firm are manufacturers of a very full line of fool-proof switch-gear, including switches for house services where a sealed device is provided. Cast iron cases are used in place of the usual method of thin sheet steel boxes. Mr. Berry reports having secured some very large orders. It is only by the principals of British firms visiting this country that the peculiar needs of Canada can be ascertained, and Mr. Berry has taken the most effective way of introducing his goods to Canadian consumers.

Trade Publications

When the Ship Comes In—A booklet issued by the Canadian General Electric Company describing Type W long life flame arc lamps for use on docks, wharves, passenger and freight terminals, etc.

Foos Gas Engines—Catalogue 91 distributed by the Canadian Allis-Chalmers, Limited, Canadian selling agents for Foos Junior gas and gasoline engines. These engines range from 2 to 8 horse-power.

Cranes and Hoists—A sheet issued by the Herbert Morris Crane and Hoist Company, Limited, Peter Street, Toronto, describing the Morris Q. E. F. Runway equipment for the quick handling of heavy material.

Fire Alarm System—Circular No. 15101, issued by the Holtzer-Cabot Electric Company, descriptive of a firm alarm equipment specially designed for schools. The equipment is well illustrated, and diagrams are shown illustrating the proper method of installation.

The 1913 Code—The National Board of Fire Underwriters has just distributed its 1913 issue of the National Electric Code, containing the rules and requirements of the National Board of Fire Underwriters, for electric wiring and apparatus, as recommended by the National Fire Protection Association.

Pittsburg Insulators.—Catalogue No. 3, issued by the Pittsburg High Voltage Insulator Company, Derry, Pa., U. S. A. In this catalogue only such insulators as are now considered standard and of approved design have been listed. The diagrams are very complete as is also the descriptive information which accompanies them.

Charging Storage Batteries—The Canadian General Electric Company have issued a very useful instruction sheet regarding the charging of storage batteries with mercury arc rectifiers. This sheet is for use as a continual reference and if tacked up near the rectifier and frequently consulted will guard the operator against many common errors.

Dynamos and Motors—Pamphlet No. 18B issued by Bruce Peebles and Company, of Edinburgh, through their Canadian agents Messrs. Roper, Clarke & Company, Montreal. This pamphlet deals with the Peebles continuous current dynamos and motors, large size, open type, and gives fully detailed specifications, numerous illustrations, weights and dimensions of the different sizes lists of ratings with technical data, etc.

Illumination

Ornamental Street Lighting in Calgary

By Mr. L. Burpee

Calgary is one of the most progressive cities of the Canadian West, and is justly proud of the progress she has made in the last six or seven years. This is shown conclusively in the growth of public utilities, which are municipally owned, one of the most important of which is the illumination of the business streets.

The city of Calgary has now a population of about 75,000, and there are 201 miles of streets, lighted by 240-250 watt, 6.6 ampere, series tungsten lamps and 860 arc lamps.

Not content with this good lighting, however, the city, last year, passed a by-law authorizing the installation of ornamental cluster standards, equipped with five 100 watt tungsten lamps, on 7th and 9th Avenues, 1st and 2nd Streets, East Centre Street, and 1st and 2nd Street West. The by-law also provided for ornamental luminous arc lamps of the C. G. E. type, on 8th Avenue. This comprises the business section of the city.

There is nothing out of the ordinary in the installation of the tungsten clusters. They are placed on both sides of the street, at about the usual distance apart, and at the usual height above the pavement. The ornamental arcs on Eighth Ave., however, are installed on ornamental brackets, attached to the street railway trolley poles, at such a height that the arcs are 16 ft. 4 in. above the sidewalk. The brackets are about 30 inches long, so that the lamps project out over the avenue by about two feet. Due to unequal spacing of trolley poles with respect to city blocks, there are ten lamps in one block, and twelve in the next. Two circuits are carried along each side of the avenue. These are supported on cross arms near the tops of the poles. The lamps are connected into these circuits in such a manner that if for any reason one circuit is out, half of the lamps on both sides of the avenue will be lighted. This serves the double purpose of facilitating, cutting out half the lamps each night at eleven o'clock (Saturday night twelve o'clock), and of reducing interruptions in the lighting to a minimum.



General effect of Luminous Arcs on Eighth Ave. Calgary



Front lighted by Magnetite Arcs—Side lighted by Tungsten Clusters

The accompany illustrations from photographs taken between ten o'clock p.m. and midnight on a dry dark night afford some idea of the excellence of the illumination of Eightth Avenue. The by-law already mentioned, has lately been changed to authorize the installation of C. G. E. ornamental luminous arcs, instead of cluster lights, on all streets and avenues enumerated above, except Ninth Ave., involving a total of about 375 lamps.

Now that the type of illuminant has been decided upon, the city is determined to put in an installation in every way second to none. One steel pole will be used where now there are three sets (wood and steel). This pole will be used in common by the Railway & Lighting Departments on streets and avenues having car service. The absolute cutout will be placed in an ornamental cap or hood on the pole top, and

wires will pass down to the lamp inside the pole and bracket. On the streets and avenues on which there is no car service, ornamental standards will be installed, the circuits being placed underground. Telephone wires will also be placed under ground.

The entire cost of the installation is paid for on a foot frontage basis, on ten-year debentures, the city paying operating and maintenance costs.

Temporary Lamp Receptacle

The receptacle herewith illustrated has been designed primarily for temporary work. It can easily be connected in circuit, because it is unnecessary to strip the insulation from the wire. The wire is placed opposite the screw, which is



then tightened so that the point at the end will puncture the insulation and make contact. This receptacle is made of mica compound and will withstand rough handling. It has been placed on the market by Pass & Seymour, Inc., Solvay, N.Y.

Ready-to-Assemble Fixtures

The handsome illustrations shown herewith are typical of the metal fixtures and fixture parts manufactured by the W. H. Banfield & Sons. This firm manufacturers a great variety of designs of ready-to-assemble fixture parts and fittings in stamped brass as well as electrolier chains in a great variety of designs and finish. Another prominent feature of their products is a swivel loop which is also made in a number of different designs. Catalogue No. 2, just issued, is splendidly illustrated and tells all about these latest designs, with prices.





New Benjamin Vapor Proof Hand Portables

The Benjamin Electric Manufacturing Company of Canada, Limited, Toronto, are putting on the market a new form of vapor-proof hand portable which is designed for use in garages, dyeing and cleaning works, and places where gases or inflammable materials are found. As shown by the accompanying cut, it consists of a strong wooden handle, medium screw base, porcelain receptacle with lamp grip for



tubular lamps mounted in cavity, a vapor-proof globe with lamp centering spring and wire guard with hinged hook. It is 13½ inches long and measures 2¼ inches in diameter. The guard can be supplied complete less cable and attachment plug or complete with one foot of cable and swivel attachment plug.

Consolidated Tungstoliers

The Tungstolier Company of Canada, Limited, announce that they are placing on the market a new line of fixtures known as the Consolidated Tungstolier Bulletins and descriptive matter are being distributed.

Montreal Underground

Work has been commenced by Mr. G. M. Gest on the Bleury street section of the Montreal underground conduits. Mr. Gest has now a very large amount of work in the district. He has three contracts for the city of Montreal and also one for the town of Outremont, a suburb of the city. Considerable progress has been made with the St. Catherine street contract, many of the big manholes being completed. The commissioners who are responsible for the entire work are engaged in drawing up plans for the inner central district, and it is hoped to call for tenders early next spring. The civic controllers had asked for the removal of the poles on Victoria Square, but the Commissioners are not able to comply with this request; the Square, however, will be included in the work to be commenced early next year.

Bracebridge, Ont.

The town council are installing a small number of Jandus Luxolabra, carrying five tungstens, on their main streets. If this test installation meets with favor, the system will be considerably extended.

Brantford, Ont.

The municipality has purchased 132 ornamental cast iron standards, which will carry Canadian General Electric four ampere magnetite arc lamps. The current will be supplied through mercury arc rectifiers. The transformers for Brantford sub-station will be supplied by Crocker-Wheeler Company, and the switching equipment by the Canadian General Electric Company. The service wires for the street lighting system will be armored cable, laid underground.

The Dealer and Contractor

Advertising With Special Reference to Electrical Contractors (con.)

By Mr. P. L. Miles

As a result of this work which was being done in connection with the development of the new house wiring business, contracts for the wiring of new stores began to come in. As in the case of the residences, this class of business was handled entirely by architects and general contractors, and gradually the salesman worked up quite a number of store-wiring jobs.

All of this development work, however, was placed on a routine basis and the salesman again found himself with little to do. He suggested to the contractor that they go after the store business, where gas was used for illuminating purposes. The salesman prepared a list of about 125 stores which were lighted by gas. This list he obtained from a personal canvass of stores after dark, jotting down the name of the firm and the address. This prospect list was then circularized by a series of four letters. One letter contained a return post-card, upon which was a request for the salesman to call and give additional information. It was stated that the prospect would place himself under no obligation by making this request and that they were only too glad of an opportunity to present their proposition. The newspaper advertisements were continued but were slightly changed to read that the firm was specializing in the lighting of stores.

The co-operation of the local lighting company was then sought in conjunction with this campaign. As a result, a central station salesman was delegated to work in conjunction with the contractor's salesman. Together they called on the store owners who had sent in the post cards requesting additional information. When this was finished they called on every one included in the prospect list. The central station salesman gave an estimate of the average monthly current bill, told of the advantages of electricity, how it could be used for other purposes, etc. The contractor's salesman gave the merchant an estimate of the cost of wiring, fixtures and lamps. Together they brought out the reasons why the merchant should discard gas and adopt electricity for the lighting of his store. The contractor felt sure that 90 per cent. of the merchants would eventually wire their stores. It might not be for one, two or three years, but when they did, they would come to him to do the work. He felt that after the campaign he would be given the first chance at the business in nine cases out of ten.

Every year just before the fall lighting season, these merchants will again receive a series of letters and afterward a call from the salesman. The contractor feels certain that some each year will sign the contract to go ahead and do the work.

Advertising alone did not increase this contractor's business over 100 per cent., but it did play a very important part in this increase. It was advertising, backed up by proper selling methods, and according to the contractor, this combination "can't be beat."

The results from these campaigns clearly show that advertising does pay—and pays well if properly put to use. Millions of dollars are annually spent for advertisements in developing other lines of business. In the last analysis the problem of the electrical contractor differs but slightly from these other businesses. The contractor has something to sell and the one way to sell it is to let people know that it is there and then to induce them to make use of it.

There are two divisions into which the advertising done by a contractor may be divided, namely, general publicity and the advertising direct to prospects.

General publicity is the advertising of the firm name and what that firm does. The result of this publicity is the creation of a reputation and a good standing in the community served. It also creates confidence on the part of the public as it is a well known fact that people believe in firms with which they are familiar and who they know are firmly established in business.

Another value of general publicity is the connecting of the firm name with the business which they do. As an instance, if a man is contemplating having a wiring job done, he immediately endeavors to call to mind who in his city does that class of business. And the more familiar he is with this firm the more likely he will be to get in touch with them and at least get an estimate for the work.

The question of curbstone wiremen might well be mentioned at this point. Nearly every electrical contractor at some time or other meets with this class of competition. It is an easy class of competition to meet providing the proper arguments are presented. In this day and age people like to do business with concerns who they know are to be trusted. They want to know that when they give a job for wiring that it will be done in the best possible manner. The business reputation of a contractor is one of the strongest arguments which can be presented to offset curbstone competition, and advertising plays an important part in establishing this reputation for reliability.

An illustration will explain this more fully.

Reputation Counts

Mr. A. is going to wire his home. Mr. Contractor and Mr. Curbstoner are competing for the work and Mr. Curbstoner has the better of the argument in the matter of price. Mr. Contractor says to Mr. A., "You know very little or nothing about electrical wiring. It is surely worth a great deal to you to know that this work will be done in a shipshape manner. It is true my price is $10 higher than your other bid. Yet isn't it worth that much to be assured that the material placed in your house will meet all of your requirements? We could put poorer material but that is not the policy of our concern. We know what is required to give you a first class installation and that is what you will receive if you give the job to us. When we have finished every possible precaution will have been taken to prevent fires. Your circuits will not be overloaded. Our business reputation is back of us and you can rest assured that if by any chance any work is not done to your satisfaction or to the satisfaction of the insurance men it will promptly be fixed."

Mr. A. knows this is true. He has seen Mr. Contractor's

advertisements in the newspapers. He knows little or nothing about Mr. Curbstoner. He can usually be convinced that the advertising phrase, "It costs more but it is worth it," is true.

So much for general publicity. Advertising direct to prospects is an entirely different nature. The first purpose of this advertising is to make people want electricity.

After this such advertising should be designed to convince them that they can afford to install it. This advertising, however, cannot be expected to bring in signed orders, as was found by the contractor mentioned above. This does not prove, however, that advertising is of no value. Hard headed automobile manufacturers spent thousands of dollars in advertising high priced cars, yet it is very seldom, if ever, that they received, through the mail or by telephone call, an order to send one of their cars to a certain address. Some articles such as candy, soap and small household utensils can, and are, sold by advertising alone. But when advertising to obtain a contract for wiring a house, which requires an investment of from $30 to $100, fixtures included, the advertisement is eminently successful if it succeeds in bringing only an inquiry. When the inquiry has been received, salesmanship should do the rest.

Don't Neglect Inquiries

The inquiry should be taken care of immediately. Numerous instances are known where a great deal of money is spent on advertising which will only produce inquiries and then, after the inquiry has been received, it is neglected. Somehow or other it should receive immediate attention, either by a letter of acknowledgement or by the call of a representative the following day. With proper sales methods a very large percentage of inquiries may be turned into actual dollars and cents. This relation of the contractors advertising to salesmanship cannot be magnified to too great an extent. While advertising may not be absolutely essential to selling, yet selling is the logical follow-up of advertising. Advertisements do not take the place of salesmen. They merely tell his story to thousands, where he could only tell it to tens. It increases the effect of his work several fold. The advertising will arouse the interest of the prospect and after this has been accomplished the salesman can step in and close the contract.

An analysis of a prospect list for house wiring will show that the names naturally divide themselves into three general classes, namely, the home owner, the tenant and the landlord. Of these three classes much better results will be obtained from the home owner. The tenant as a rule will not bear the expense of the wiring, inasmuch as he may want to move and his expenditure will be lost to him. The landlord will not wire the house unless he is practically forced to do so by the tenant. In some instances, however, it is a comparatively easy matter to induce the landlord to wire his house when vacant, arguing that it will be easier rented and with the lesser argument that there will be a great saving in redecorations. But as stated above the home owner will prove the most valuable prospect. He owns the home in which he lives and is heartily interested in the comfort and welfare of his immediate family. The expense which he makes in connection with wiring his home materially increases the selling value of his property. Instances have been known where, with an expenditure of only $75 for wiring and fixtures, an owner was able to demand $250 more than his original selling price. When looked at from the proper viewpoint, the home owner is not undergoing an expense, but is making a good investment which may bring good returns.

As shown by the experience of the previously mentioned wiring contractor in obtaining the business of wiring new houses, it is a combination of price and business reputation which will bring results. Practically all the dealings are with the architect or general contractor, the actual owner seldom interfering in matters of this sort. It is not necessary to induce these people to make any additional expenditure for wiring—this having all been decided with the laying out of the plans. According to central station managers practically 99 per cent. of all new houses are wired for electricity when built—and this without the call of a salesman. Electricity is the modern light and people want it in their new home.

The obtaining of this business, therefore, resolves itself into becoming acquainted in one way or another, with the architects and builders—showing them that your work will be entirely satisfactory and that the price is consistent with the quality of the labor and material to be furnished. Advertising alone can be of very little assistance in obtaining the business. The price and quality of the work play the important part, supplemented by good salesmanship.

The various advertising mediums which are available to the electrical contractor consist of direct-by-mail letters, including pamphlets as enclosures, show windows, the daily newspapers, programs, street car cards, billboards, electric signs, and stereoptican slides for moving picture theatres. By far the most important of these is the use of the mails. This should be the basis of the campaigns, the other forms of publicity being used in conjunction.

The newspapers are especially valuable for the purpose of general publicity. But when it is possible to obtain a list of prospects, every one of whom may be interested in the subject of electric wiring, it is of paramount importance that this be reached by letters and pamphlets, and this advertising supplemented by the uses of the newspapers.

Just a few words relative to developing the sale of electrical appliances, portables and lamps, which are handled by quite a large proportion of the wiring contractors. Advertising plays a very important part in the development of this business.

First of all, who are the only prospects for these articles? Electric light users, and electric light users alone. People whose houses are not wired for electricity are not in a position to use any of these appliances, and advertising material sent to them is practically wasted. They are the people who should be interested in house wiring.

An absolute list of electric light users is, of course, the list of central station customers. This list includes practically every prospect in a specified town. This list as a rule may be obtained from the central station manager. He realizes of course that every flatiron which is sold means additional current consumption to his company. In towns which are lighted by a municipal plant the record of customers is usually open to the public and may be abstracted in a day or so by a stenographer.

Once such a list is secured it should be worked to the limit. Many progressive contractors having a list of central station customers, are circularizing these names with a letter or pamphlet every month. This advertising deals with some seasonable subject, such as fans in the summer time and electric radiators in the winter time.

Window Advertising

Much has been written about the value of the display window as an advertising medium. Yet horrible examples of neglected windows are constantly recurring. In some even the plate glass is not kept clean but is dirty and grimy. In others the merchandise is literally dumped into the window where it is allowed to stay for three or four weeks, with the accumulated dust and tarnish. All of this reflects on the store, and gives it the earmarks of sloth.

The advertising value of the show window lies principally in the fact that people may see the actual goods—not merely pictures—and after seeing, they may make a purchase by going into the store. The more attractive the more likelihood of bringing them into the store. They do

not have to go out of their way—the store is directly in front of them. It requires very little time and planning to install a good window display—an hour will do the trick. Window displays are of known value—and their neglect on the part of any merchant is neglect of an excellent business opportunity.

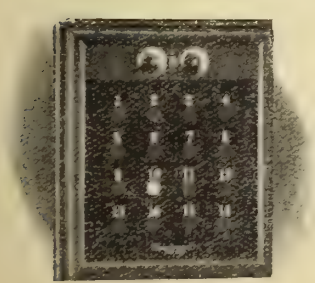
The individual preparation of pamphlets and booklets, as well as that of newspaper cuts and copy, is usually a very expensive proposition—entailing greater expense than could be borne by the average contractor. For instanuce, in the preparation of a booklet on house-wiring in a 1,000 lot quantity the expense would probably be 10 cents apiece, or $100. Yet if these books were prepared in 100,000 lot quantities, the expense would run as low as 2 cents or 3 cents apiece, which is a material reduction.

Nearly all of the manufacturers have booklets, pamphlets, newspaper cuts and copy, which they will furnish to the electrical contractor, imprinted with his firm name, and dealing with practically every phase of the development of the contractors' business. Many of these features are furnished free of charge, while for others a very small charge is made, practically one-quarter of the cost if the individual contractor prepared the advertisement himself. Also very few contractors have, or can afford, a publicity man or rely upon an advertising agency to prepare the advertisement. This is both expensive and many times unsatisfactory. The manufacturers have advertising experts who devote practically all their time to advertisements relative to certain classes of business. They study the conditions and are in an excellent position to furnish the best material obtainable. There are at present four or five booklets on house wiring, as well as numerous pamphlets relating to the sale of lamps and electrical appliances, which could be successfully used by the contractor. Upon request, most of the manufacturers will submit a series of form letters, prepared by their advertising man, which may be used in connection with campaigns.

New Type Annunciator

The Connecticut Telephone & Electric Company of Meriden, Conn., have recently placed on the market a new type of electrical reset annunciator. The outfit contains many new and interesting features for the electrical trade.

Heretofore annunciators have been built mostly of the mechanical reset type. The demand, however, seems to be increasing for the electric reset style. The Connecticut annunciator drop consists of two independent magnet coils. One operates the drop and the other resets it—there are no permanent magnets of any kind. By a unique and positive arrangement only the independent reset magnet is in the restoring circuit after a drop has been operated, thus one reset button can be used for any annunciator, regardless of size. Each drop is a self-contained unit, and can be removed from the annunciator by disconnecting two wires and removing one machine screw. All drops are mounted on a vertical metal mounting strip which gives a rigid and substantial construction. As will be seen by one of the cuts herewith, all parts including drops, bell and reset buttons are mounted on the back board so that when the front of the cabinet is removed, they are accessible in their working condition. This is an ideal arrangement for the contractor. All drops are wired to terminals on the back board with machine binding screws for connecting to line wires. The reset button is also wired to two terminals so that an extension reset button may be used, if so desired. The company claim this outfit occupies less space than most other drops and the current consumption is extremely small. Another very interesting feature is the fact that if the glass is broken it will not necessitate remarking the drops, for the reason that the marking is done on a well finished ferrotype plate and the glass is placed over the same.



Type S Annunciator



Cover Removed

New Appleton Equipments

The fitting illustrated in Fig. 1 herewith, is a new "Unilet" conduit box. This is a combination cut-out and snap switch unilet, double-pole, 250 volt, manufactured by the Appleton Electric Company. This fitting is particularly adapted

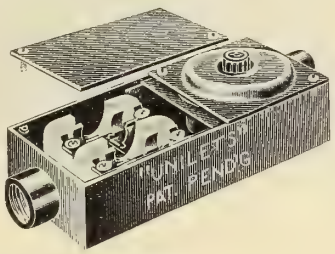


Fig. 1

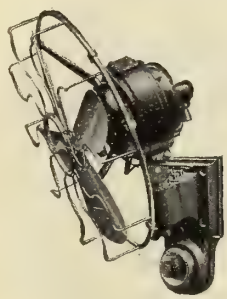


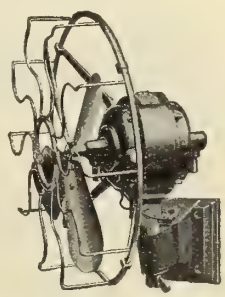
Fig. 2

for use on machines which are operated by individual motors.

The fitting illustrated in Fig. 2 is a new vapor-proof "Unilet" manufactured by the same company. This fitting will be found very valuable where the lamps are subject to severe weather conditions, dampness, etc.

The Westinghouse Electric & Manufacturing Company have introduced modifications of their standard fans, adapting them to railway coach use. Their drawn steel frames are characterized by grace and strength. Their quiet operation and economical use of current, and the fact that they last for years without attention, except oiling once every six months, make them an economical fan to buy. The wall



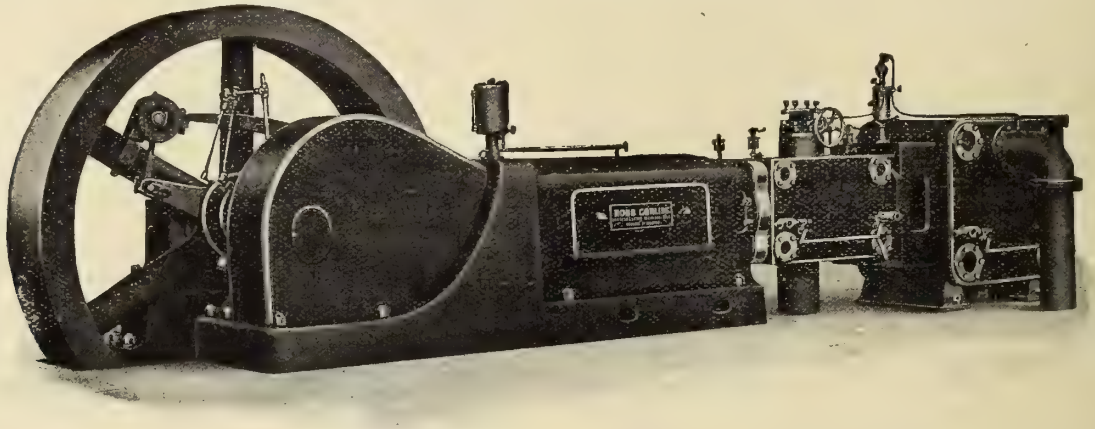


mounting fans are generally mounted on the sides or ends of the car or in the smoking compartment. For places where it is desired to have the control switch at the same location as the fan these fans are supplied with a switch attached to the base, see figure.

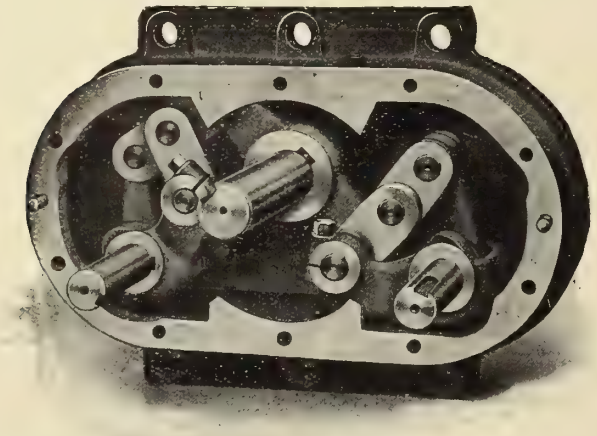
For use on electric railway cars, including subway, surface, elevated and interurban, where 500 to 600 volts is the prevailing voltage, the standard railway coach fans, without switch, wound for 220 volts are supplied with special resistor to take up the extra voltage. They have one lead grounded to prevent shock to any person coming in contact with the fan. The resistor also contains a choke coil to reduce the rush of current when the fan is first connected to the line.

Robb Corliss Engines

Many persons have hesitated to install the Corliss type of engine because its speed is too low, especially for driving a generator direct-connected. With shorter stroke, much higher speed, positive operation of valves and complete enclosure of moving parts, this type of engine, however, has been brought to overcome the above objections without any sacrifice of the usual advantages of the Corliss valve gear—almost perfect steam distribution, independent adjustment of the events of the stroke, small clearance, and separate cylinder ports for admission and exhaust which reduce cylinder condensation. The Robb Engineering Company have placed on the market a type of Corliss engine which operates at speeds from 90 to 225 revolutions per minute—an advantage resulting from the modified Corliss valve gear used in their design. This high speed is made possible by simplifying the gear so as to eliminate all springs, dash pots, latches, cams, and disengaging parts so that the number of working parts has been reduced to about half. Further, the absence of these delicate parts is claimed to make a smoother running engine with so little wear on the gears that steam economy and good regulation are maintained for years. In



Tandem Compound Robb Corliss Engine, Type "F"



Valve Gear Casing—Cover Removed

other respects the Robb Corliss type is designed on the lines of modern heavy duty Corliss engines. A relatively short stroke and compact substantial frame with plenty of metal in the direct line of strains overcome the vibration in the long stroke girder frame design and the reciprocating parts are carefully balanced.

Full pressure of steam comes very quickly into the cylinder of this engine because of the triple port opening through the admission valves, and there is free exit through the exhaust valves at the proper time because of the double port opening. The steam pressure is well taken care of by the large surfaces of the valves which are nearly balanced by carrying the metal around the top; this results in a long life and a minimum wear on the valves and seats.

The valve action does not depend on a releasing gear, for quick opening and closing is the distinct feature of the Robb Corliss engine, but the action imparted to the valve is identical with that of drop cut-off gears. Two small links between the wrist plate and the valve crank do away with springs, dash pots, latches and cams, making a positively driven valve gear which may be operated at high speed. The valve gear is positive, that is, it does not let go of the valves, but, with positive action, opens them quickly, closes them promptly, and holds them stationary during the closed period which is half the time and constitutes that period when the unbalanced pressure between the steam pipe and the cylinder would cause friction. Enclosing the valve gear in a tight casing so that all working parts are in a bath of oil reduces to a minimum friction and wear so detrimental to releasing gears.

It is further claimed that a more desirable and economical steam distribution is possible with the double eccentric arrangement, as it permits of an independent setting of exhaust valves for release and compression. Two eccentrics are used in the Robb-Corliss engine, one forming a part of the governor and controlling the steam valves and the other operating the exhaust valves.

The cut-off is controlled direct by a governor which is a modification and improvement on the Sweet's shaft governor. It is located in the fly wheel of the engine and drives the valve gear and controls its operation. Simplicity and power are combined in this governor by reducing the number of main parts to three and carrying the centrifugal weight upon a spring entirely independent of any bearings.

The moving parts of the engine are completely enclosed, affording ample protection and cleanliness. The bed castings are so arranged that the oil is retained and carried to the crank pit and from this point, distributed to all the bearings of the engine by means of an oil pump. Positive lubrication is thus assured although as an additional safeguard an oil reservoir is mounted on top of the engine, ready for immediate use. Cylinder lubrication is provided by a sight feed lubricator and by a positively-operated power pump with oil pipes leading to the cylinder at the proper points.

The reciprocating parts of the engine are balanced by properly counterweighting the cranks and setting the valves to give correct compression to cushion the reciprocating parts at the ends of the stroke.

Current News and Notes

Ancaster, Ont.

A deputation from the village of Ancaster interviewed the Hon. Adam Beck with reference to a supply of power.

Calgary, Alta.

The contract for steel valves and fittings for the new power plant has been awarded to the General Supplies Limited, Calgary.

A filtration plant and pumping station with daily capacity of 40,000,000 gallons is being discussed.

Forest, Ont.

The town of Forest recently purchased the plant of the Hamilton and Prout Electric Light Company, by expropriation, and are now building a new power station near the town hall. They will use the same generating equipment, and transfer it to their new building. The distribution system, however, will be extended, and concrete poles installed, similar to those now in use in Toronto. The street will be illuminated with 100 watt tungstens, in series, installed on brackets on the poles. The generating equipment consists of a 70 kv.a. Westinghouse unit. This was reported in our September 1st issue as being new equipment, but, as stated above, it is only a transfer from the old power house. Mr. H. A. MacLean, town engineer of Sarnia, is supervising the work.

Fort Frances, Ont.

The by-law authorizing the payment of $5,000 for the private telephone system has been passed. It has been said that the system will be reconstructed, and an attempt made to lower the rates.

Fort Henry, Ont.

It is said that work will start, in the near future, on a wireless telegraph station at this point. The work will be carried on by the Department of Marine & Fisheries of the Dominion Government.

Fort William, Ont.

At the last meeting of the City Council it was decided that all efforts possible would be made to have the street railway extensions across the Kaministiquia river to Island No. 2, completed and in operation before the end of the present year, which will be a great accommodation for the many workmen employed on the various industries in this locality.

The city of Fort William will take over their end of the electric railway this coming fall. Heretofore the city of Port Arthur has controlled the street railway under a joint board, made up of representatives from both cities. Formal steps have already been taken in connection with the operation of an interchange service, between the two cities. It is not thought that there will be any material change in the service, except that cars will run at shorter intervals.

Galt, Ont.

The illumination of Jackson Park, by ornamental standard clusters is being considered.

Goderich, Ont.

The municipality has purchased sixty Jandus Luxolabra, three and one light, ornamental standards, which will be installed around Court House Park.

The Goderich Board of Trade has been discussing the construction of a number of interurban electric lines, and the Hydro Commission may be asked to report on the matter.

Hamilton, Ont.

The contract has been awarded to Mr. G. M. Gest, for the construction of Hamilton's underground conduit system. The total cost will be in the neighborhood of $1,750. Somewhat less than half of this will be borne by the city, private companies in Hamilton paying the balance.

The Hamilton Street Railway Company have placed in operation their new Barton street extension, and the cars are now running through to Kenilworth avenue.

Inglewood, Ont.

The Shale Products Limited, of Inglewood, Ont., have just completed the installation of a power transmission line, from their water power plant to their brick plant, a distance of about one mile. The water plant consists of a 70-inch Barber wheel, operating under a 10 ft. head, which drives a 125 kv.a. Westinghouse 2300 volt, 25 cycle, 3-phase generator. Motor equipment at the brick plant includes two units operating at 2200 volts, and two smaller units at 550 volts. Mr. T. H. Graham is president.

Kingston, Ont.

Tenders are called up to September 15 for the supply and installation of approximately 20,000 duct feet of conduit. Mr. C. C. Folger is general manager of the Light, Heat and Power Department.

London, Ont.

It is now said a vote will be taken during the early part of October on the question of the electrification of the London & Port Stanley Railway.

Lindsay, Ont

On September 3 a by-law carried, by a large majority, authorizing a contract with the Electric Power Company to illuminate the streets of the city. Magnetite arcs will be used on the main street. Mounted on ornamental standards. Service wires for the arc lamps will be underground.

Minett, Ont.

The Cleveland House Hotel have installed a Lister-Bruston automatic electric lighting plant to do their lighting and pumping. The plant was supplied and installed by the R. A. Lister Co., Ltd., Toronto, Ont.

Montreal, Que.

Following their policy of constantly renewing their permanent way, the Montreal Tramways Company are putting in new intersections at the principal points of the system. The rails are much heavier, and the roadbed is also of a more substantial character.

The stock of poles and wires of the Merchants' Telephone Company, Montreal, which went into liquidation a few months ago, has been purchased by the Bell Telephone Company. The stock will be utilized in the construction of new lines by the Bell Telephone Company.

Business in the electrical trade has been dull for some time, and some of the larger companies have laid off men. There are indications, however, of a revival and prospects are good for a satisfactory fall trade.

A federal charter has been obtained for the Southern Canada Power Company, Limited, with the head office in Montreal. The company have power to carry on operations throughout Canada as a light, heat and power company, and to produce and convert heat, light and power from hydraulic,

pneumatic or other energy or from gas or otherwise, "provided, however, that any sale, distribution or transmission of electric, hydraulic of other power or force shall be subject to local and municipal regulations."

New Westminster, B.C.

The city of Westminster has purchased a 150 h.p. electric hoist, for operating a clam shell bucket on a derrick. The hoist has three drums, arranged according to "the waterfall" type, and is also equipped with a Clyde "Type A" bull-wheel swinger. The 150 h.p. motor is a 3-phase, 60 cycle, 220 volts induction motor with outboard bearing bolted to bed extension. It develops 720-700 revolutions per minute. The controller has a contractor panel which automatically throws in the resistance, making it impossible to start the motor above a safe speed. The outfit was made by the Clyde Iron Works, of Duluth, for Messrs. Taylor & Young, Vancouver, from whom it was ordered by the city of New Westminster.

North Bay, Ont.

A telephone despatching system has just been placed in operation over the T. & N. O. Railway lines.

Ottawa, Ont.

The contract for supplying the municipal electric commission of Ottawa with 47,698 feet of paper insulated, 3-core, lead covered, 3,300 volt cable, has been awarded to the Imperial Wire and Cable Company, of Montreal. The Canadian Westinghouse Company have also been given a contract by the commission for the supply of regulators for $16,935 and the Canadian British Insulated Company will supply 1,098 feet of armored cable for $752.13. The insulated cable is for the new underground mains that the commission proposes to put in, thus doing away with the overhead wires.

Port Carling, Ont.

Dr. Ellen Burt Sherratt has installed a Lister-Bruston automatic electric lighting plant at Ewa Yea, her summer home. The equipment was supplied by the R. A. Lister Company, Limited.

Prince Albert, Sask.

The cost of the municipal hydro-electric scheme is said to be running into much larger figures than was originally estimated. The work has been held up in the meantime and C. H. & P. H. Mitchell, consulting engineers for the city, have been asked to report again on the probable total cost.

Regina, Sask.

A new pumping unit of 5,000,000 gal. capacity has been recommended by Commissioner L. A. Thornton.

An extension of the ornamental street lighting system is under consideration.

The developments of the past six years in the municipally owned public utilities in Regina are exemplified by the increasing surplus as shown in the power plant department. In 1912 this was $71,200, as compared with $20,833 in 1907. This is in the face of a reduction in price from 25 cents per kw.h. to from 7c to 1¼c. In special cases a 1c rate is given. Regina is at present building a $425,000 power house and is spending a further $250,000 in power and light extensions.

Souris, Man.

A by-law was passed on September 2nd, authorizing the expenditure of $40,000 on an electric light and power plant.

Sault Ste. Marie, Ont.

A fire at the power house of the Lake Superior Corporation on August 25 put the plant temporarily out of commission.

Smith's Falls, Ont.

The Smith's Falls Electric Light Company, Limited, are doing away with their old 133 cycle single phase lighting system, and are installing a Westinghouse 275 kw., 3-phase, 60 cycle generator for lighting and power. The water wheels are being rearranged so that there will be three 300 h.p. wheels belted to the line shaft, to which also a new Goldie & McCulloch 500 h.p. high speed, steam auxiliary can be coupled for peak requirements. The transmission lines are also being altered considerably to take care of the new system. Mr. Geo. B. Frost is general manager.

St. John, N.B.

Negotiations are still underway between the street railway company and the city council regarding line extensions to Kane's Corners.

Sydney, N.S.

Gross earnings of the Cape Breton Electric Company for the year ending June 30, 1913, amounted to $373,788, an increase of $27,350 over 1912. The gain in net was $18,052. The Cape Breton Electric Company controls the entire electric railway and lighting business of Sydney, N.S., the ferry business between Sydney and North Sydney, and an interurban line between North Sydney and Sydney Mines. It also controls the Sydney and Glace Bay Railway Company.

Toronto, Ont.

The Civic Transportation Committee have advised the creation of a Metropolitan area with an approximate radius of twenty miles, to be under the supervision of a Commission of three. The Commission would include (1) an electrical, (2) a road and parks, and (3) a health commissioner.

The Hydro-electric Power Commission have started work on the extension of the step-down transforming station at the foot of Strachan avenue.

Truro, N.S.

The town council have decided on the installation of a municipal electric plant and will require generators, and all necessary auxiliary equipment as well as a complete equipment for ornamental standard street lighting.

Vancouver, B.C.

The B. C. E. R. Company have submitted a proposition for the lighting of Saanich Municipality. The rates offered are 3½c per kw.h. if a minimum of 500 80-watt lamps is used, or 3c if 1,000 lamps are taken.

Westboro, Ont.

The Ottawa Electric Company have been awarded the contract for supplying the village of Westboro with fifty 100-watt tungsten lamps at $13 each per annum. The contract, when approved by the ratepayers on the 19th inst. will be in force for ten years. Poles for the lights have been ready for some time.

Westport, Ont.

The Westport Rural Telephone Company, Limited, has been incorporated, and will construct and maintain a small telephone system.

Winnipeg, Man.

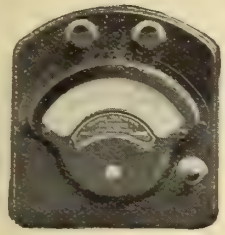
A contract has been awarded to the Canadian Westinghouse Company for the supply of three 5,000 kv.a., 2-bearing, direct coupled type, 3-phase, 6600 volts, 7,200 alternations, 138½ r.p.m. generators.

Wolseley, Sask.

On August 27 a by-law was passed authorizing the purchase, by the town, of the plant of the Central Light & Power Company. The town will take over the plant as soon as possible and will install all the improvements that had already been recommended by the engineer in charge, viz., a 30 kw. generator immediately and a 150 h.p. producer gas equipment next year.

Yorkton, Sask.

Contract has been awarded for a new municipal telephone exchange at Yorkton, Sask., to cost $18,000, to Logan & Black, of that town.



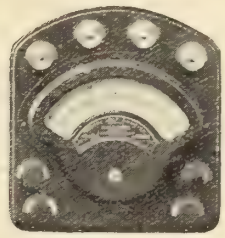
Model 280, Single Range Portable Voltmeter. (One-quarter size.)

WESTON

Miniature Precision Instruments for Direct Current

A new group of very small Indicating Instruments.

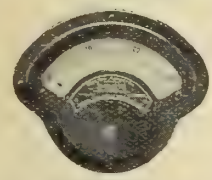
COMPACT—ACCURATE— DURABLE—BEAUTIFUL



Model 280, Triple Range Portable Volt-Ammeter. (One-quarter size.)

PORTABLE

Voltmeters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters are supplied in single, double and triple ranges.
The Volt-Ammeter comprising six instruments in one.
This group also includes BATTERY TESTERS.



Model 267, Switchboard Ammeter. (One-quarter size.)

SWITCHBOARD

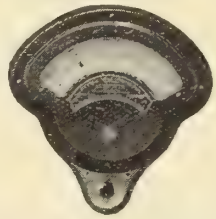
Voltmeters Volt-Ammeters Ammeters Mil-Ammeters

This new line of instruments represents the latest development of the pivoted moving coil, permanent magnet type for low ranges.

The refinement of design and mechanical work in them has been carried to a degree which would appear to be almost impossible of accomplishment, if the results were not evident in the instruments themselves.

They embody characteristics which have made the well known Weston Standards famous throughout the world.

They are accurate, dead beat and extremely sensitive.



Model. 268, Switchboard Volt Ammeter. Reads Amperes. Press Button for Volts. (One-quarter Size.)

They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.

They are substantially constructed and may be safely sent long distances through the mails and will withstand an extraordinary amount of vibration without injury.

They have the longest scale ever provided in instruments with equal length of pointer.

Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.

The portable instruments may be conveniently carried in the coat pocket.

The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate cost.

If you cannot obtain the instrument desired from your dealer, write us.

The several models and ranges offer a selection from over 300 different combinations, listed in Bulletin No. 8. Will be mailed upon request.

WESTON ELECTRICAL INSTRUMENT COMPANY,

Main Office and Works: NEWARK, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Block
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
St. Louis, 915 Olice Street.
Denver, 221 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 618 Union Trust Bldg.
Montreal, Winnipeg, Vancouver, Calgary — Northern Electric & Mfg. Co.
Toronto, 76 Bay Street.
Paris, 12 Rue St. Georges.
London, Audrey House, Ely Place, Holborn.
Berlin, Genest Str. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Buildings, Harrison Street.

"UNILETS"

are drawn from steel and are light in weight, neat in appearance, and their durability cannot be surpassed. They are the ideal conduit fittings for up-to-date work and should be used by all contractors and those desiring their installations to be perfect in all respects. "UNILETS" are mechanically right. Furnished in either Black Enameled or Sherardized finished.

Rectangular Steel Unilets for ½" to 3" conduit inclusive



Cat. No. 9000



Cat. No. 9001



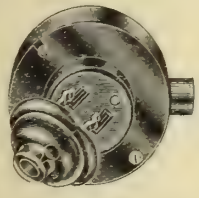
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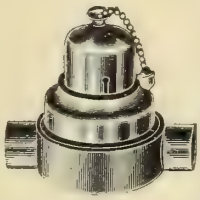
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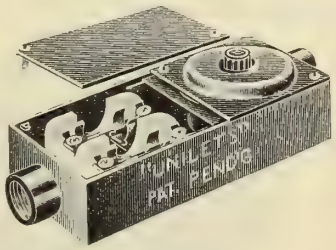
Cat. No. 9008



Type No. 1—4 inch Round Unilet with Two-phase Receptacle Attached.



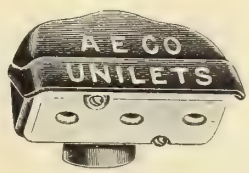
Cat. No. 7402 Snap Switch Unilet with Hubbell No. 5795 Pull Switch Attached.



Combination Cut-Out and Snap Switch Unilet-Double Pole—250 volt.



Cat. No. 6906 Vapor-Proof Unilet.



Cat. No. 10 Service Entrance Unilet with No. 6003 Cover Attached.

Copy of booklet "UNILETS" sent on request

APPLETON ELECTRIC COMPANY

Main Office and Factory — **CHICAGO** — **212-214 N. Jefferson Street**

For Sale in Canada by

The Mainer Electric Co., Ltd., Winnipeg — **Marshall-Wells Co., Ltd., Winnipeg** — **Chapman & Walker, Ltd., Toronto**

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

CITY OF REGINA, SASK.

Sealed tenders, registered and clearly marked on the outside of the envelope "Tender for Power House Equipment," and addressed to the City Commissioners, Regina, Saskatchewan, will be received up until noon of October 25th, 1913, for the supply of:—

One 3000 K.W. Steam Turbine with condenser.

One 25 ton capacity, hand power crane for 45 foot span.

Specifications may be obtained from E. W. Bull, Superintendent of Light & Power Dept., Regina, Saskatchewan.

A marked cheque for 5 per cent. (5 p.c.) of the amount of bid must accompany tender.

The City Commissioners reserve the right to reject any or all tenders. 18-19

CITY OF REGINA, SASK.

TENDERS

Sealed tenders, registered and clearly marked on the outside of the envelope "Tender for Power House Equipment," and addressed to the City Commissioners at Regina, Sask., will be received up until noon of October 1st, 1913, for the supply of:—

Coal bunkers, ash hoppers, coal and ash conveyors and crushers.

Price to be on equipment erected on foundation built by the City of Regina according to contractors' requirements.

A marked cheque for 5 per cent. of the amount of bid, and made payable to the City Treasurer, City of Regina, must accompany each tender.

Specifications may be obtained from E. W. Bull, Superintendent of Light and Power, Regina, Sask.

The City Commissioners reserve the right to reject any or all tenders.

17-18

Engine and Generator For Sale

Owing to the Town of Stayner having secured a supply of power from the Hydro-Electric Power Commission of Ontario this equipment will not be needed after Sept. 1st. 1913.

1 100 H.P. 2 cylinder vertical Fairbanks-Morse Gas Engine, complete with oiling system, 5 years old.

1 Fairbanks-Morse Gas producer, complete for above.

1 30 K.W. 1,000 volt, 133 cycle single phase Royal Electric Generator, complete with exciter.

1 set of line shafting, complete with pulleys, clutches and belts.

1 marble panel switchboard with control equipment for generator and exciter.

1 Bulldozer Power Pump.

1 Duplex Plunger Pump.

1 Water Motor.

JOSEPH KNOX,
Stayner, Ontario,

For Sale—16 long burning and enclosed, 60 cycle A.B. arc lamps, 40 light A.B. regulator and 12 C.G.E. enclosed lamps. Wanted within 6 months, 400 kw. 60 cycle generator. Cataract Electric Co., Ltd., Orangeville, Ont. 18-19

FOR SALE

Lights		Speed
2	450 Gen. Elec. type C. form T, direct-connected to Curtis form A non-condensing turbine, 100 lbs. pressure, 25 kw., 125 volt	3600
2	450 Gen. Elec., 6-pole, form L, 25 kw., direct-connected to Westinghouse vertical gasoline engines	350
1	540 Gen. Elec., 6-pole, form F, comp., 30 kw. direct-connected to 11 x 8 in. Gen. Elec. vertical marine type engine, 125 volt	305
1	1300 Northern, MP, 75 kw., comp., direct-connected to Racine vertical cross comp. engine, 125 volt	275
1	1300 Westinghouse, 6-pole, comp., 75 kw., direct-connected to 14 x 14 Ames auto, center-crank horizontal engine, 125 volt	275

Send for our "Monthly Bargain Sheet" showing complete list of machines on hand with net prices. Every machine sold is completely overhauled and fully tested at our works before shipment, and is sent out practically "as good as new."

We Buy, Sell, Rent, Exchange and Repair.

GREGORY ELECTRIC CO.
CHICAGO, ILLINOIS

Established 1893.
1601 S. Lincoln Street. 14-t.f.

Situations Wanted

Canadian electrical engineer of many years' experience, leaving shortly for England, would execute one or two commissions for clients. Address Box 877 Electrical News, Toronto. 18



Manager (M.I.E.E., Fellow A.I.E.E.) desires situation. Technical and commercial engineer, 17 years in electrical field. Member of several technical societies. Has built and operated electric light and power, electric railway, hydraulic properties. Well posted upon utility commission investigations and municipal work. Expert in high tension, long distance transmission and management of hydro-electric properties and operation of properties that require reorganization and development. Address Box 863, Electrical News, Toronto. 17-18

TENDERS

FOR

Fire Alarm Boxes, One Ten Circuit Protector Board, One Eight Circuit Storage Battery Board, One Motor Generator Set, Three Full Joker Sets, Copper Wire, etc.

Tenders addressed to the undersigned will be received by registered post up to noon on

Tuesday, September 23, 1913.

for supplying the above named articles.

Specifications and forms of tender, together with the conditions governing tenders, as prescribed by city by-law, may be obtained at the office of the Fire Department, No. 152 Adelaide street west, Toronto.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.

Toronto, Sept. 3, 1913. F

Moonlight Schedule for October 1913

Courtesy of the National Carbon Company, Cleveland.

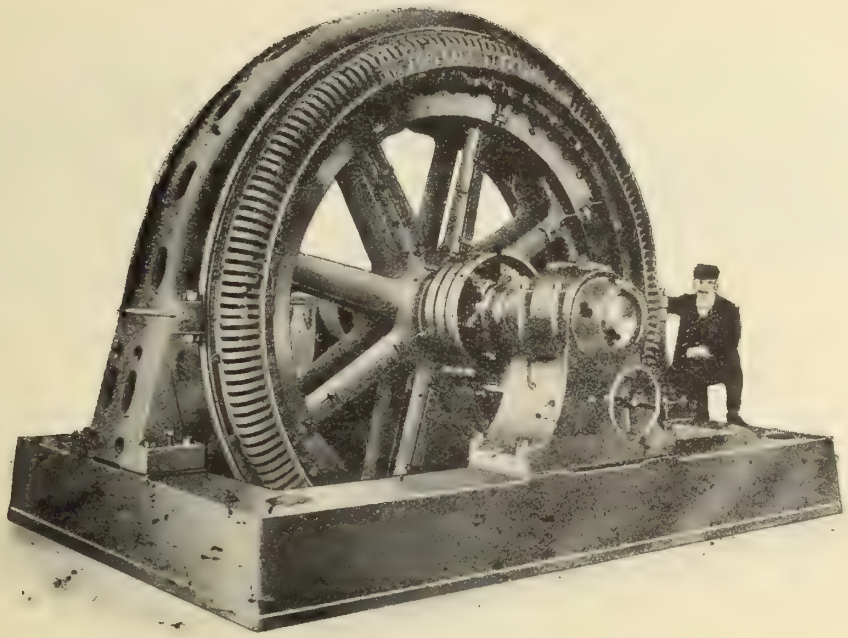
Date.	Light.	Date.	Extinguish.	No. of Hours
Oct. 1	6 10	Oct. 2	5 10	11 50
2	6 10	3	5 20	11 50
3	6 10	4	5 20	11 50
4	6 10	5	5 20	11 50
5	6 10	6	5 20	11 50
6	6 10	7	5 20	11 00
7	10 00	8	5 20	7 20
8	11 00	9	5 20	6 20
10	0 00	10	5 20	5 20
11	1 10	11	5 20	4 10
12	2 00	12	5 30	3 30
13	3 00	13	5 30	2 30
14	No Light	14	No Light	
15	No Light	15	No Light	
16	No Light	16	No Light	
17	5 40	17	7 40	2 00
18	5 40	18	8 20	2 40
19	5 40	19	9 00	3 20
20	5 40	20	10 00	4 20
21	5 40	21	11 10	5 30
22	5 40	23	0 20	6 40
23	5 40	24	1 30	7 50
24	5 40	25	2 50	9 10
25	5 40	26	4 10	10 30
26	5 30	27	5 20	11 50
27	5 30	28	5 40	12 10
28	5 30	29	5 40	12 10
29	5 30	30	5 40	12 10
30	5 30	31	5 40	12 10
31	5 30	Nov. 1	5 50	12 20

Total Hours.....220 50

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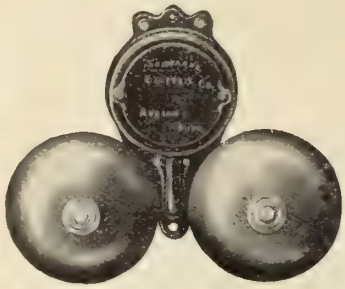
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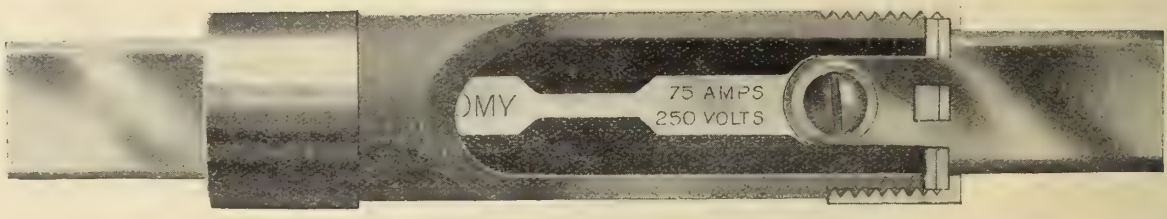
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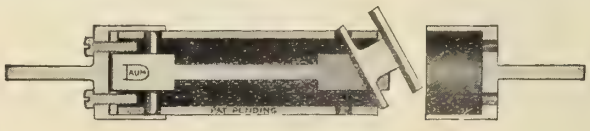
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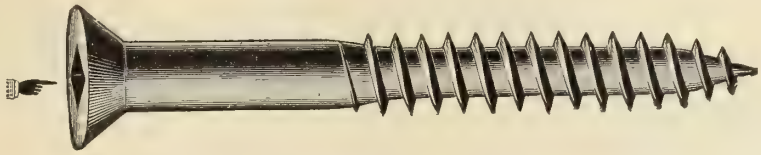
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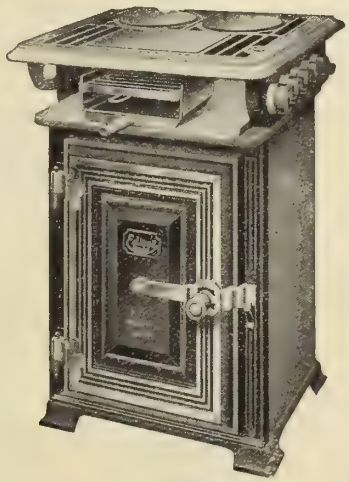
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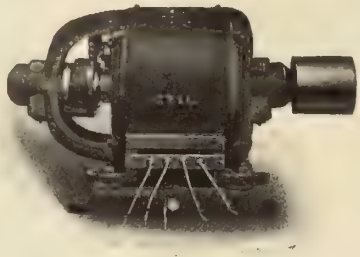
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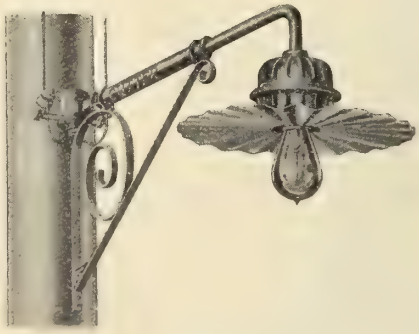
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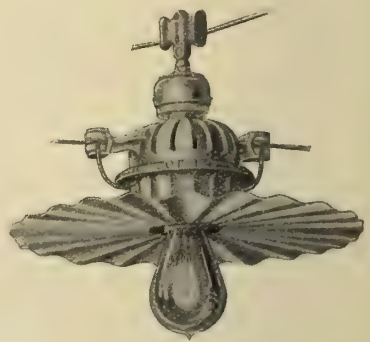
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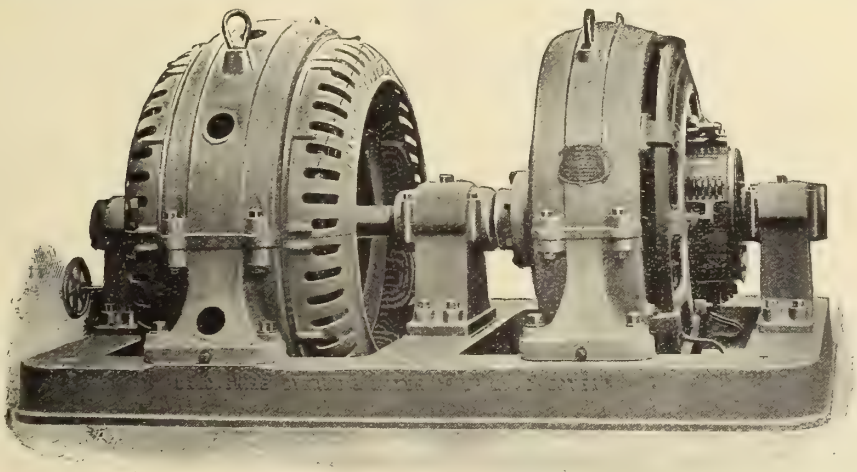
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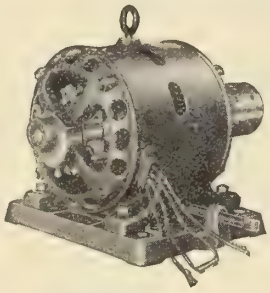
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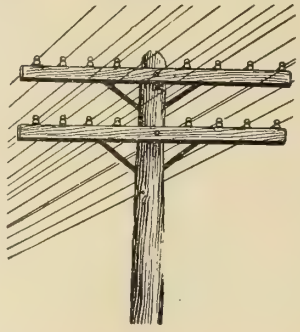
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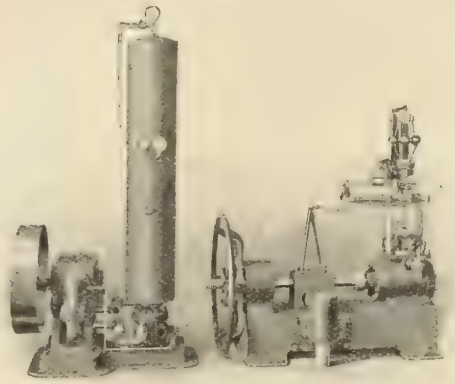
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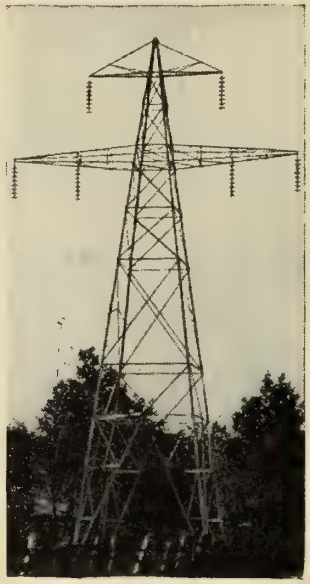
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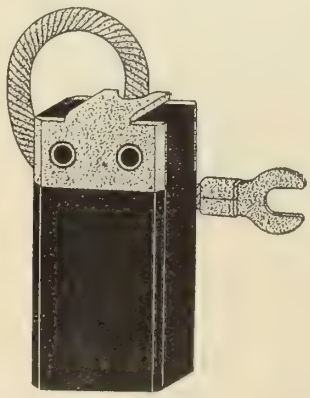
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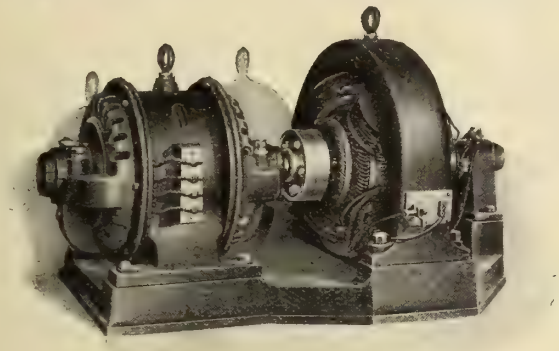
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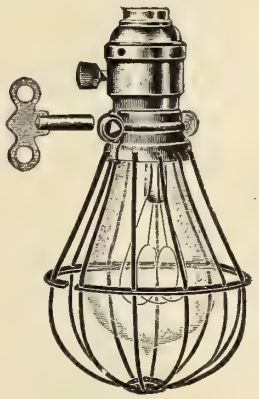
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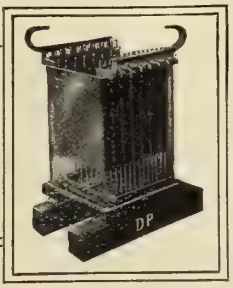
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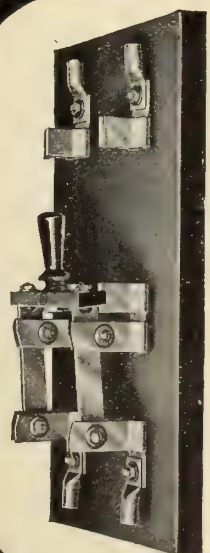
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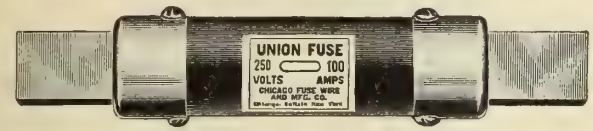
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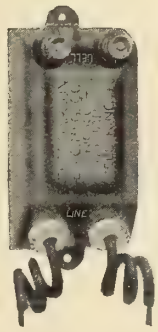
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Carefully designed and constructed by experts you can make no mistake in handling the

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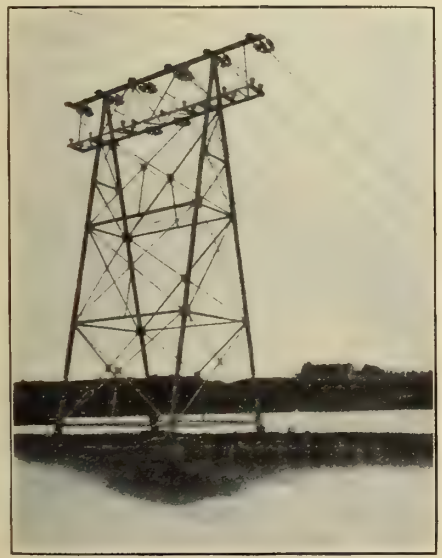
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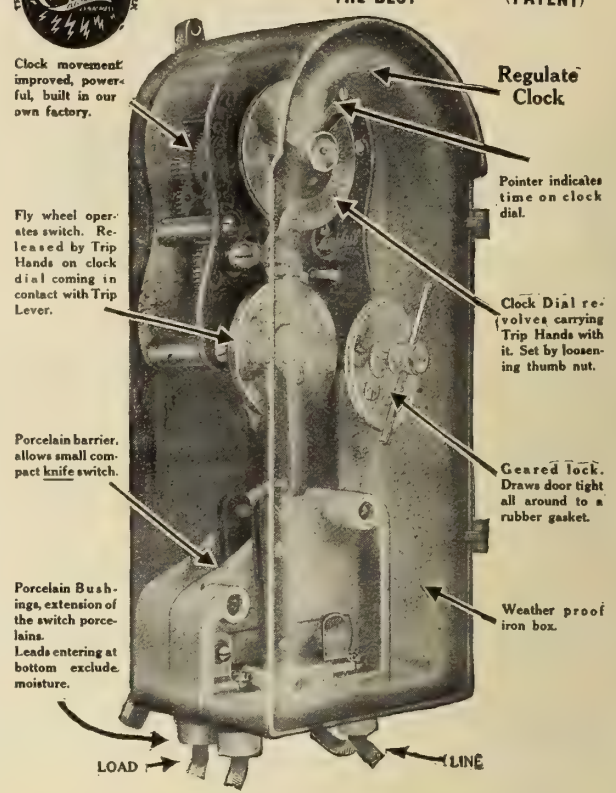
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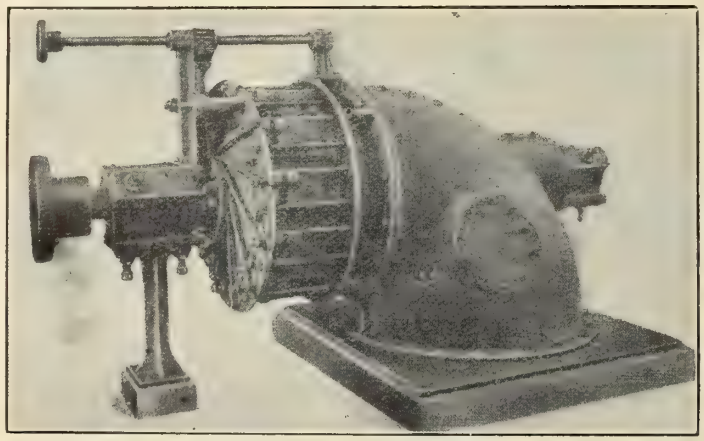
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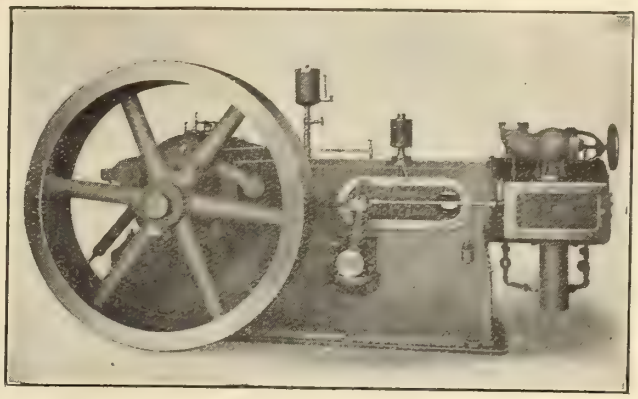
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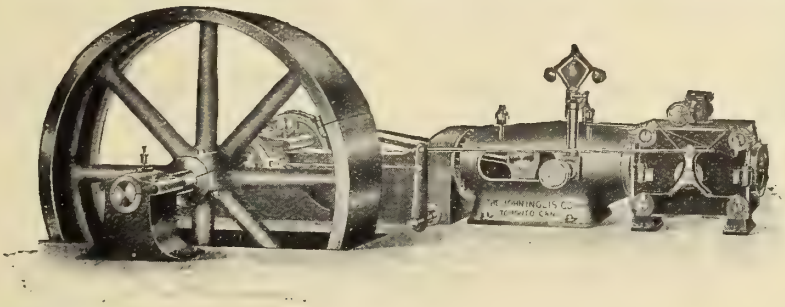


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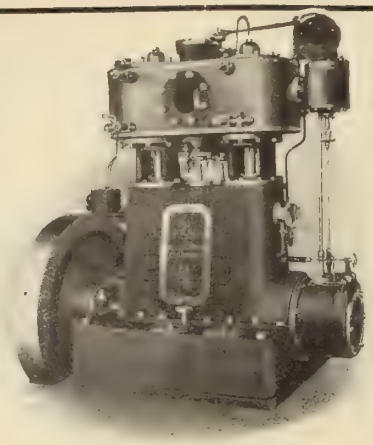
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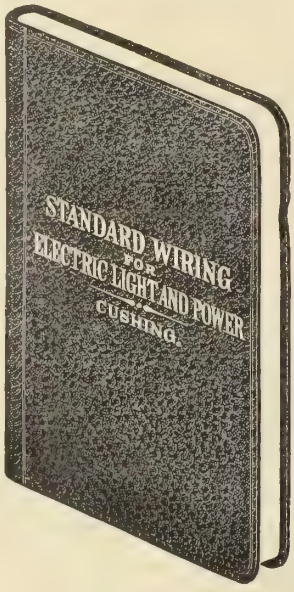
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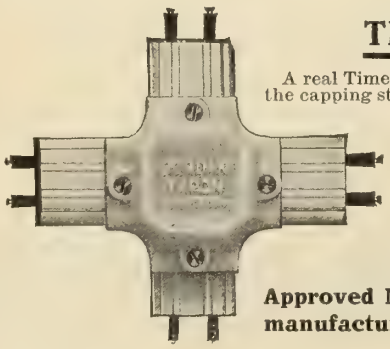
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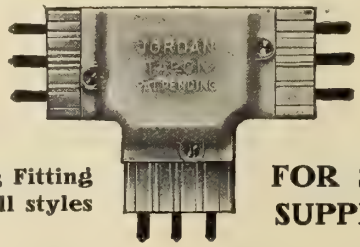
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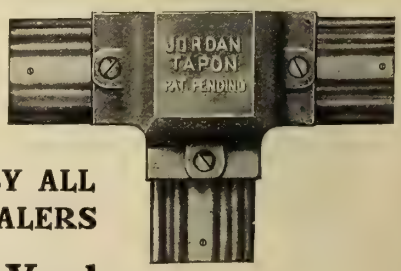
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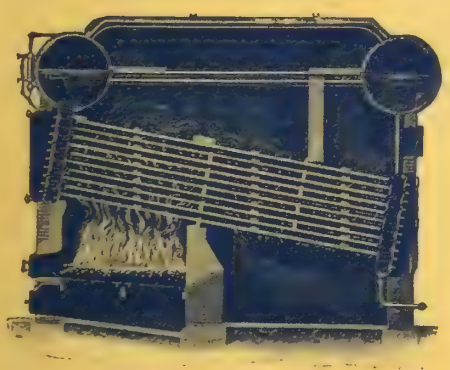
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Do you want the best, or will you take a chance? Why disguise the issue?

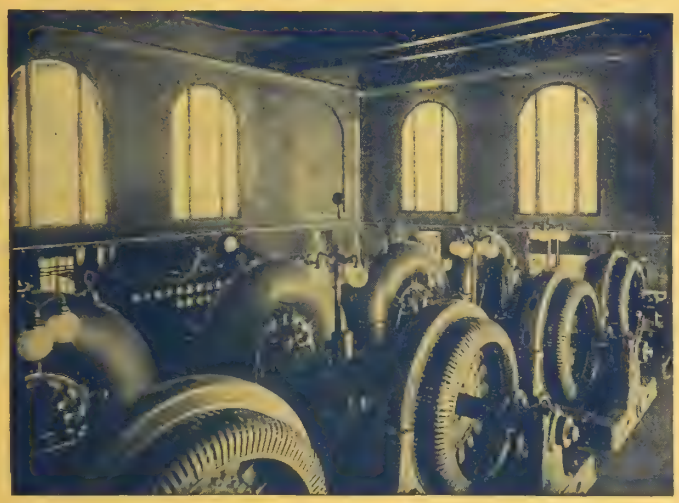
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Vol. XXII—No. 19 Toronto, October 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



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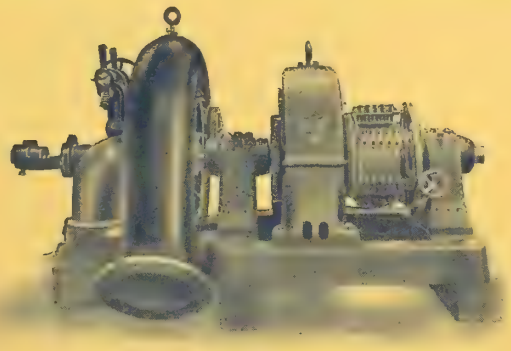
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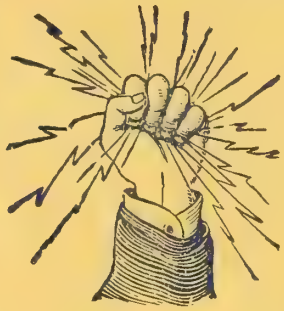
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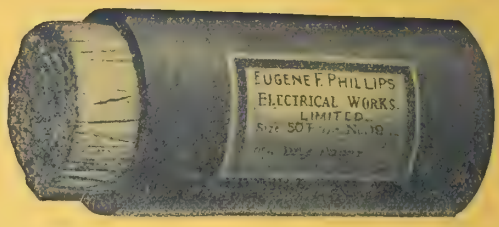
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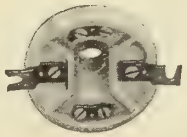


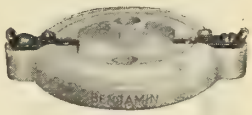
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Plug Cutout





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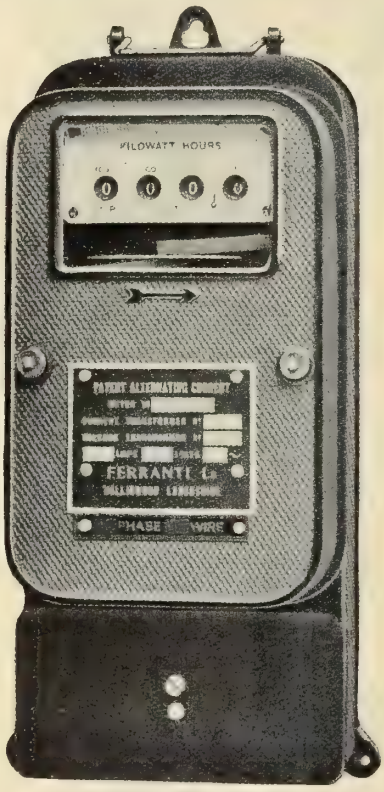
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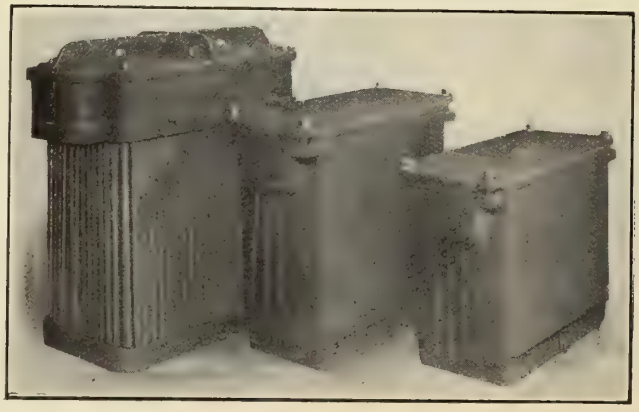
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Further particulars and an estimate on your next job will cost you nothing.

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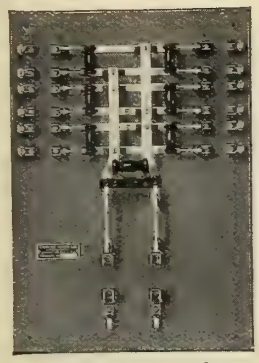
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That Embody Advanced Structural Principles
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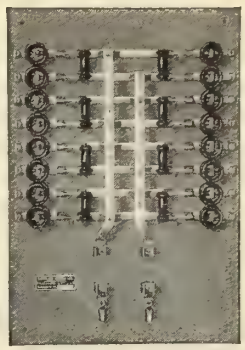
Type "A" Panels [125 and 250 volts]—Branches arranged for enclosed fuses and with or without knife switches.

Type "D" Panels [125 volts]—Branches arranged for plug fuses and with or without knife switches.

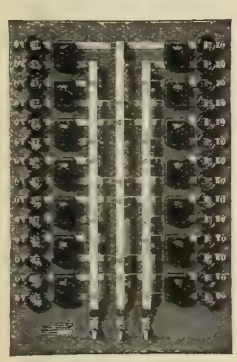
Type "F" Panels [125 and 250 volts]—Branches arranged for enclosed fuses and snap switches.

Type "H" Panels [125 volts]—Branches arranged for plug fuses and with snap switches.

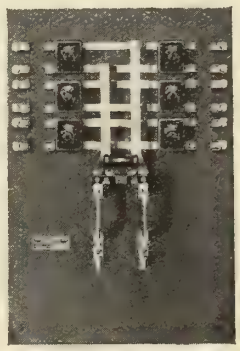
Our designs in Cabinets embrace fifteen types—all steel, steel and wood combined and wood with slate lining, either for flush or surface mounting and with side or back gutters, also without gutter.



Type D Panel



Type H Panel



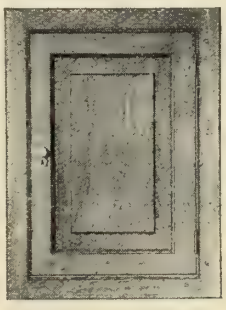
Type F Panel



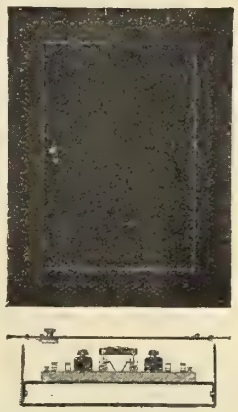
Type M Cabinet



Type DFP Cabinet



Type ESQ Cabinet



Type CL Cabinet

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City..... Prov..... 21013

Across Canada with the

IMPERIAL WIRE & CABLE CO.
LIMITED

Toronto - MONTREAL - Winnipeg



Fourth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows the Electric Railway Chambers Winnipeg

This building was wired with "Imperial Higrade" Rubber Insulated Wire

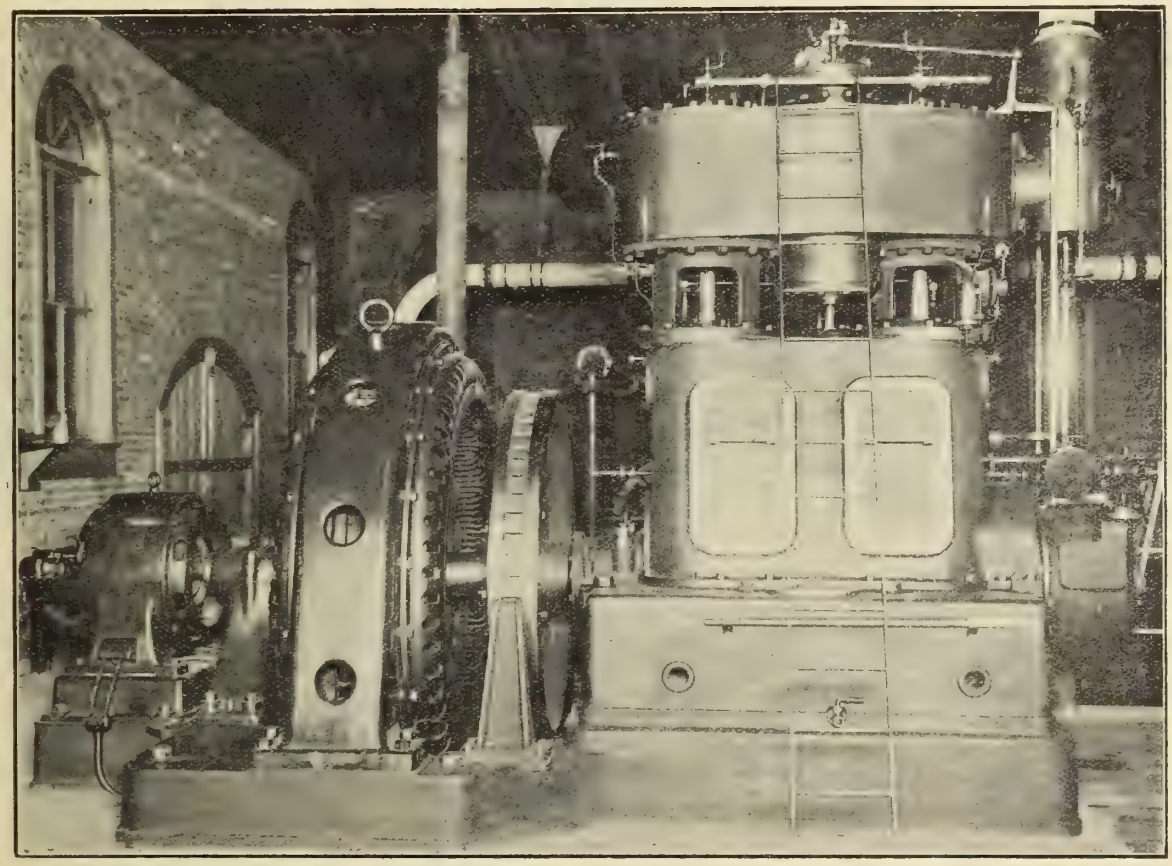
Architects - - - - - - Pratt & Ross, Winnipeg
Engineers - - - - - Neiler, Rich Co., Chicago
Electrical Contractors - - Schumacher Gray Co., Winnipeg

Address enquiries to nearest office—Montreal—Toronto—Winnipeg

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Limited, Calgary and Vancouver.

"ADANAC," "IMPERIAL HIGRADE" and "30% PARA"

High Grade Electrical Apparatus



375 K.V.A. 2300 volt 2 phase 60 cycle 360 R.P.M. A.C. generator direct connected to a Belliss & Morcom high speed engine supplied to the corporation of Wetaskiwin, Alta.

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR

The General Electric Co., of Sweden

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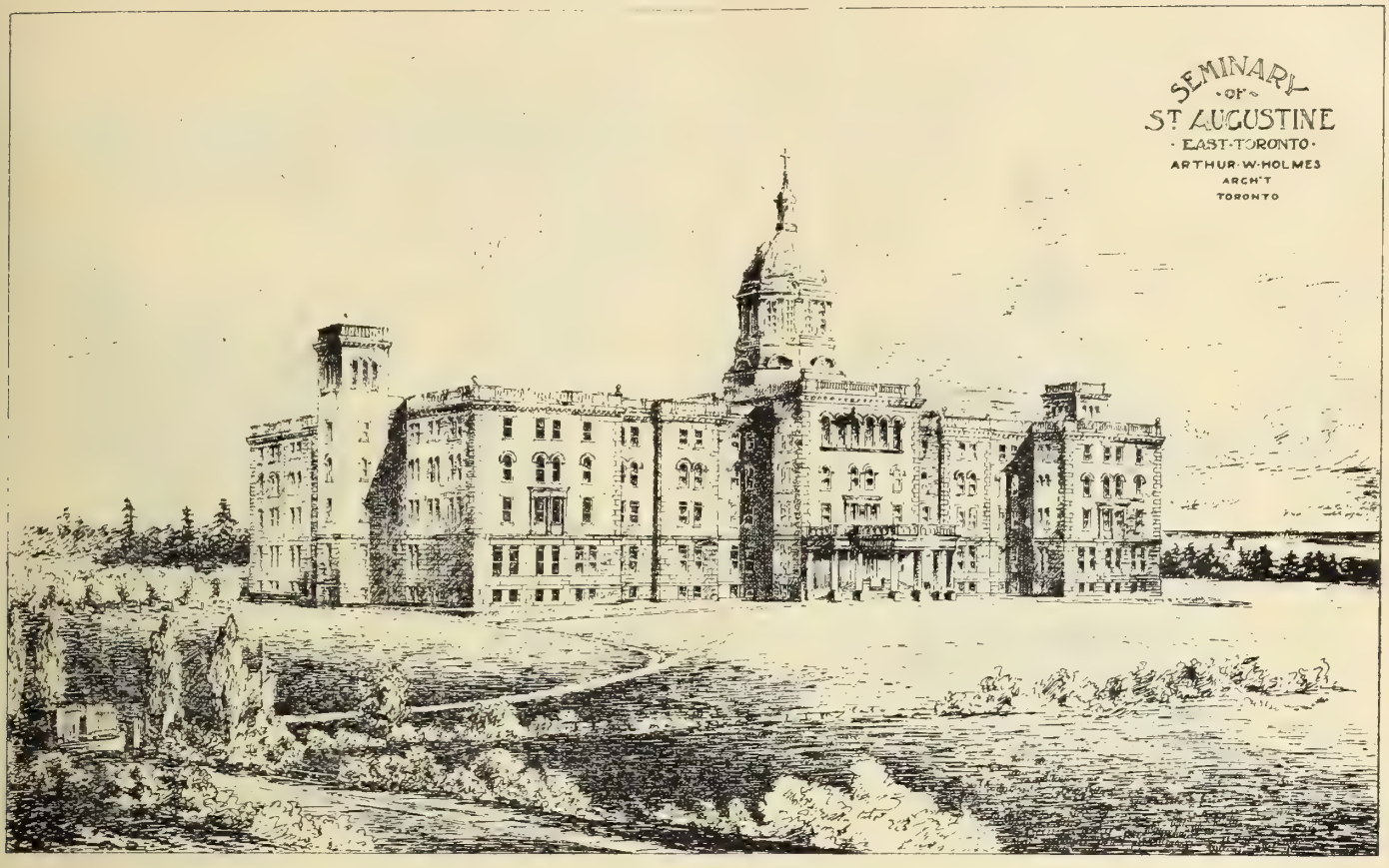
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Seminary of St. Augustine, on the Kingston Road. A "GALVADUCT" Building

GALVADUCT
AND
LORICATED

The largest buildings in every part of Canada have their wiring safely housed in the above conduits

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated.

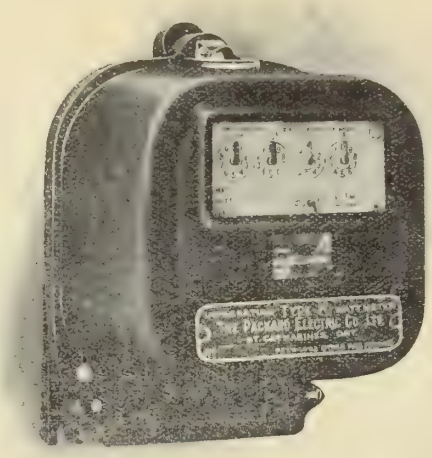
"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

Conduits Company Limited.

Toronto - Montreal



Metal Case Type "K"



Polyphase Type "PK"

METERS are the watch men of your power and light circuits—

PACKARD METERS

of the new improved construction are at all times

Accurate and Reliable

IT is this permanent efficiency which makes "Packard" Meters the best types to use on your lines. We have incorporated many improvements which make them doubly sure of giving lasting satisfaction.

Look out for your revenue and at the same time give your customers satisfactory service by installing "Packard" meters on your lines.

Many types in metal or glass cases for circuits of all descriptions.

Large stock carried at

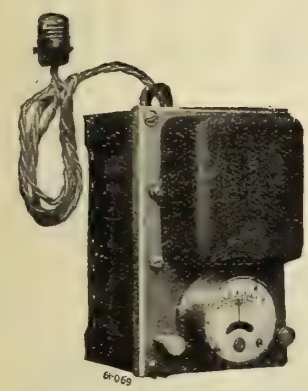
St. Catharines and Winnipeg
St. John Railway Co., St. John, N.B.
General Supplies, Limited, Calgary, Alta.
Rudel-Belnap Machinery Co. Can. Express Bldg., Montreal, P.Q.

The Packard Electric Company, Limited

Factory at—ST. CATHARINES

General Sales Office :
901-902 Traders Bank Building, TORONTO
N. W. Office and Warehouse, WINNIPEG

PUSH THE BUTTON AND HAVE LIGHT



ELECTRIC LIGHTING MADE POSSIBLE FOR EVERY CAR

Buy a WAGNER RECTIFIER and charge your storage batteries the simplest, easiest, and cheapest way. Just wire your car and convert your oil and gas lamps to electric.

The Wagner Rectifier

will charge the battery while you sleep. It is portable: weighs twelve pounds; put it in the tool box. Connect the rectifier to any alternating current lamp socket—connect the battery to the Rectifier, turn the switch—that is all.

NO SLOPPY CHEMICALS

NO GLASS TUBES

THE LIGHTEST ELECTRIC LIGHT EQUIPMENT

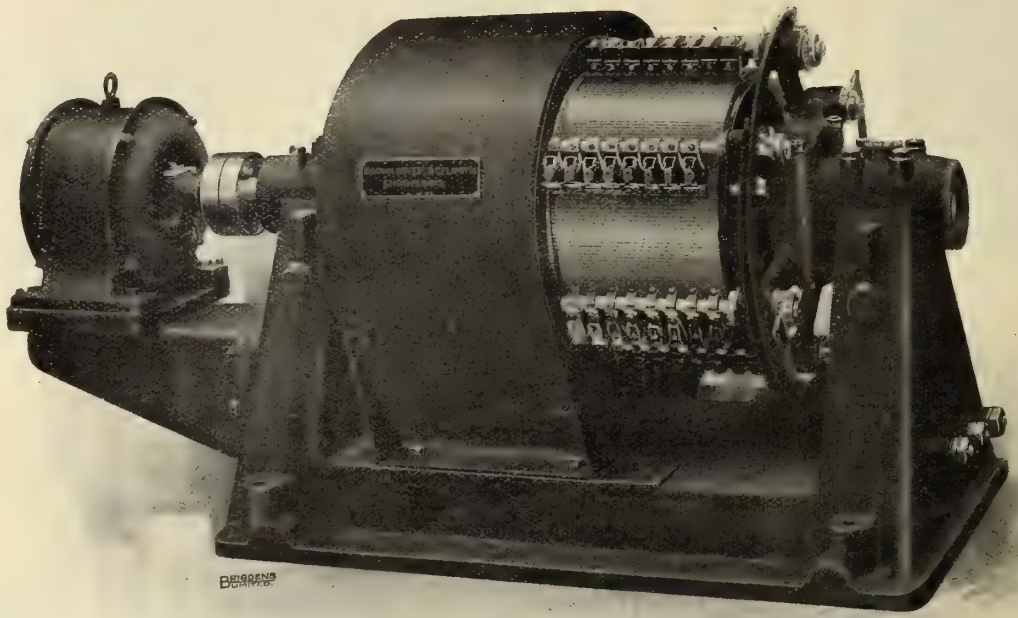


Write for Bulletin 10013

Wagner Electric Manufacturing Company
of Canada Limited–Montreal

2193

THE BROWN BOVERI PHASE COMPENSATOR



Phase Compensator for use with Induction Motors.

A high POWER FACTOR results in

Better Regulation
Smaller Line Losses
Less Capital Outlay.

Brown Boveri Compensators make these features possible by raising the power factor of induction motors to 100 per cent. or to a leading value. The combination of induction motor and compensator offers the advantages of both asynchronous and synchronous machines without their disadvantages.

Your power factor trouble may be one we can remedy.

Mail particulars to

THE CANADIAN CROCKER-WHEELER CO., LIMITED

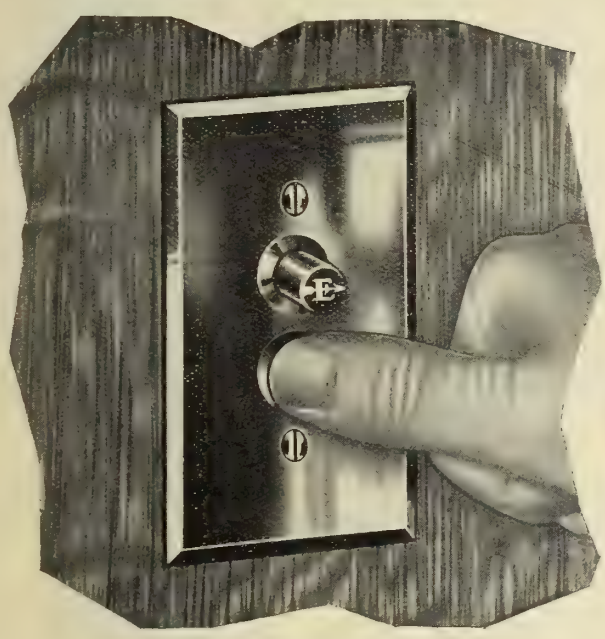
MANUFACTURERS AND ELECTRICAL ENGINEERS

HEAD OFFICE AND WORKS: St. Catharines. DISTRICT OFFICES: Montreal. Toronto. Vancouver.

THE SWITCH THAT CONTROLS THE LIGHTS



is an important factor in any installation.



You can depend upon

"ARROW E" Push Button Switches

to give real service

They are
STRONG and RUGGED,
OPERATE SMOOTHLY and QUIETLY.

Built for
LONG LIFE and RESERVE CAPACITY.

You will find them installed in many prominent buildings throughout Canada.

"Quality plus Service"

Made right and guaranteed to be right.

Use the new "ARROW E" catalog

Canadian Distributors:

THE Northern-Electric AND MANUFACTURING CO. LIMITED

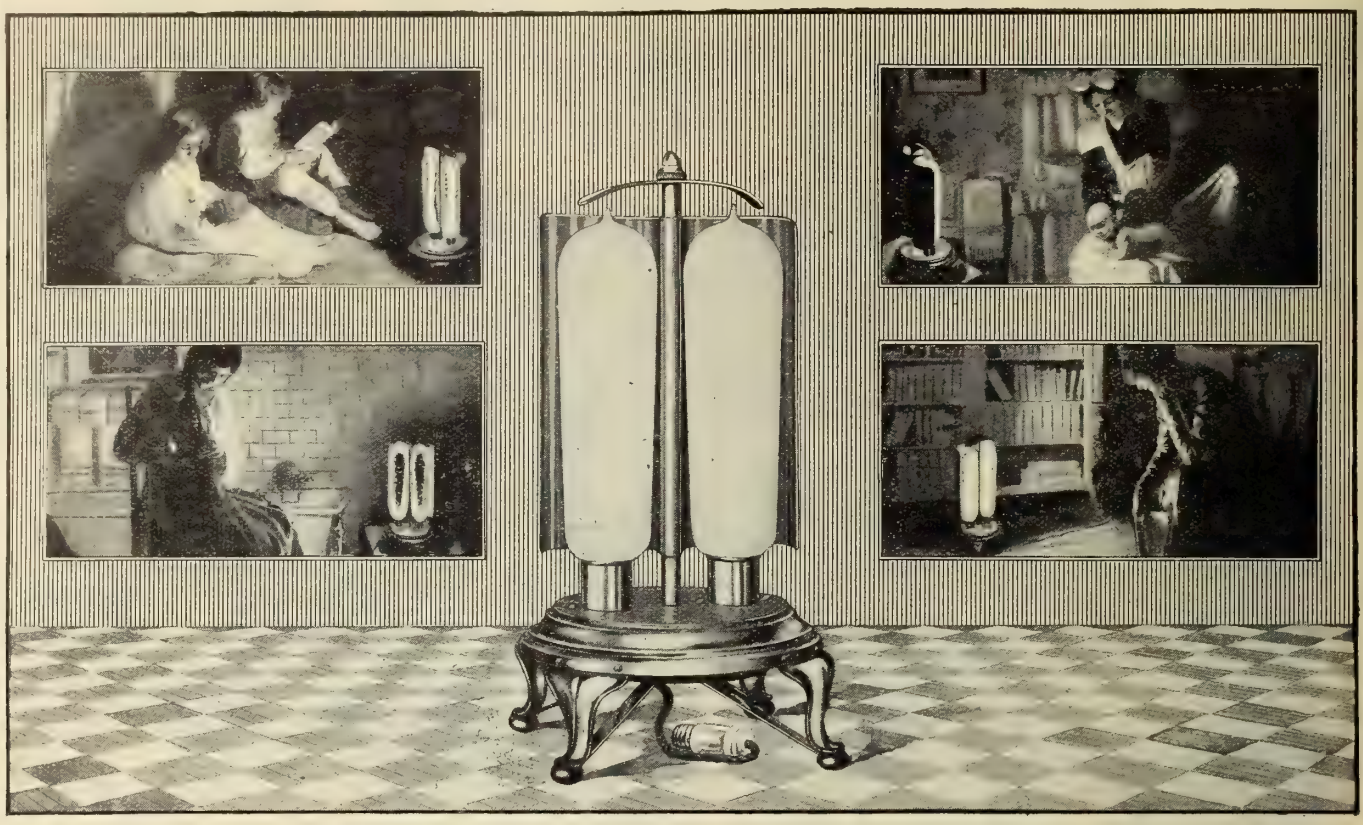
MONTREAL
REGINA

HALIFAX
CALGARY

TORONTO
EDMONTON

WINNIPEG
VANCOUVER

This Trade Mark the Guarantee  **of Excellence on Goods Electrical**



The Season for Twin Glower Radiators

The chilly mornings, damp days and cool evenings of autumn create a natural demand for a portable electric heater of moderate cost.

Take advantage of this seasonable demand and push the sale of C. G. E. Twin Glower Radiators now.

If your stock is low, write us. If you have never handled them, order a few samples.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

On Heavy Traffic Lines

Where the Service is Severe on Your Overhead

Replacements Can Be Minimized

By The Use of C. G. E. Form H Hangers And Form J 2 Ears



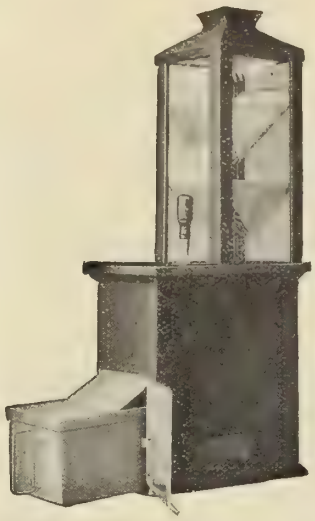
A Heavy Traffic Corner, Toronto

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert.

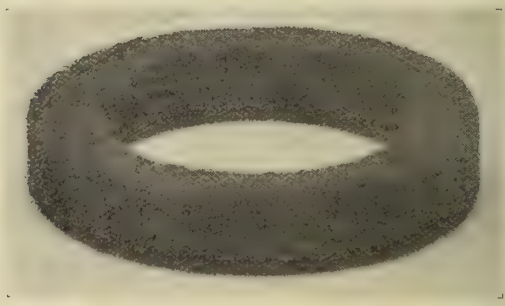


Cleveland Fare Box Co.

5310 St. Clair Ave., Cleveland, Ohio

Booth

Mechanical Felt Goods



At Gananoque, Ont., we have the dies, the plant, the felt, the men and the experience to turn out mechanical felts that are cheaper and better than can be obtained from any other source.

If it's made of felt, ask Booth

The Booth Felt Co., Limited

GANANOQUE, ONT.

Branch of N. E. BOOTH, Brooklyn, N.Y.

SIMPLEX QUALITY

SIMPLEX QUALITY,

Means Simplex Electric Completeness

attention to the little matters of comfort to the user as well as to the obvious needs of thorough construction, efficient, economical operation, facility and simplicity in use. For instance:

The push-button connector for detachable cords, removable without friction.

The automatic safety cutout for all devices with self-contained heaters

The regulator stand (automatic or hand control) for all industrial applications of electric irons.

The cord suspension arm for electric irons.

It is such things as these that help sales and satisfy customers.

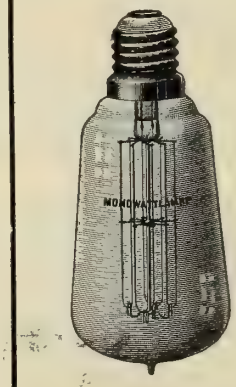
SIMPLEX ELECTRIC HEATING CO.

Mfrs. of Everything for Electric Heating and Cooking

BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.

SAN FRANCISCO, 612 Howard St.



GWIAZDA

TUNGSTEN LAMPS

One watt per candle power in all sizes. Best Quality

in stock at

G. LEWIS

Sole Agent

P. O. Box 1513 3 St. Nicholas St., MONTREAL

GMUR & COMPANY, LIMITED

Aarau, Switzerland

CAPITAL $ 200,000

Carbon Filaments in all Shapes and Sizes **Flexible Metal Filament "Uranit"**

Drawn Light Wire "Uranit" **Supports** Carbon, "Uranit" Alloy Molybdenum, Molybdenum Alloy

Tungsten-Molybdenum Wire in all Sizes

LARGEST SPECIAL FACTORY FOR LAMP FILAMENTS



Federal Electric Signs - Durable and Attractive

¶ As long as the wall is left to hold the Federal Sign up, it will keep its attractive appearance. The standard colors, a brilliant white upon a royal blue background, afford the greatest contrast. They make the sign effective and attractive by day as well as by night. The colors are porcelain enamelled upon sheet steel and cannot lose their brightness. Ornamental end pieces and crowns can be supplied which add to the appearance of the sign.

¶ Federal Electric Signs are constructed of the best material obtainable and are almost indestructible The frame is of heavy galvanized channel iron. Each letter is stamped out separately from sheet steel and screwed securely to the frame. The hanging rig is heavily galvanized to protect it from the weather—the whole sign is fire and waterproof and **can not** rust. The Federal Electric Clamp socket is used, the porcelain projecting beyond the pure copper shell to prevent the entrance of moisture. And the Sign is fully approved by the Underwriters National Electric Ass'n.

Central Stations will find facts and figures in Bulletin No. 27111. Write for it today. Federal Signs sold F.O.B., Factory, Hamilton, Ont.

TRADE MARK

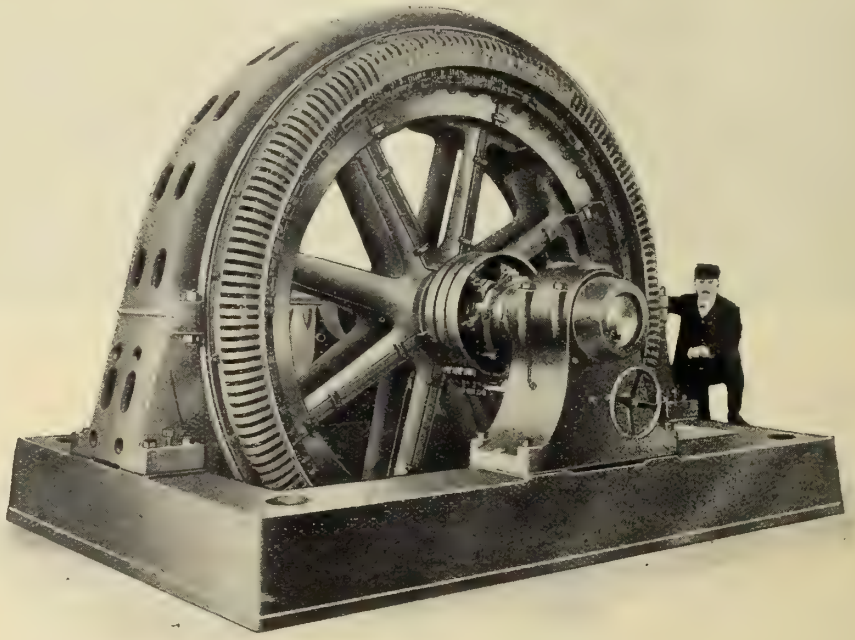
Federal Sign System (Electric)

Lake and Desplaines Streets, Chicago, Ill.

Swedish Electrical Machinery

Noted for

Efficiency and Workmanship



2700 H.P. 2200 Volt. 214 R.P.M.—25 Cycle—3 Phase—Slip Ring Type Induction Motor direct connected to Pulp Grinder.

We solicit your specifications for Electrical Equipment

BURNHAM ENGINEERING COMPANY

LIMITED

Canadian Dealers for

The Amalgamated Electric Company of Sweden

Head Office:
Traders Bank Building,
TORONTO

Montreal Representatives:
Rudel Belnap Machinery Co., Ltd.
Canadian Express Bldg.



NULITE DRAWN WIRE TUNGSTEN LAMPS

A further big reduction has been made in the prices of **Nulite** lamps. Remember that though **Nulite** lamp prices have periodically decreased since their introduction, their quality already "unexcelled" is steadily improving.
Write for complete price lists and discounts.

The Canadian Tungsten Lamp Company, Limited, Hamilton, Canada



Sunbeam Mazda Lamps Made The Change

Time was when the old gas standard served to light the streets of many big cities. Since the advent of Sunbeam Mazda Lamps the old gas standard has become obsolete.

There is a big demand for these lamps—do you sell them.

Your jobber can supply you.

Canadian Sunbeam Lamp Co., Limited

Main Office and Factory: TORONTO

Branch Warehouses:
MONTREAL WINNIPEG CALGARY VANCOUVER

Moonstone Glass



4054—60 Watt



4052—40 Watt



4050 –25 Watt



4056—100 Watt

The Sanitary Reflectors here shown were especially designed for Hospitals There is an entire absence of crevices thus preventing the collection of dust and germs. Another notable feature is that the reflectors can be easily cleaned without being removed from the fixtures. Moonstone Glass was given the preference over all other semi-translucent glasses by the lighting committee of the Toronto General Hospital, on account of its color and efficiency.



4058—150 Watt



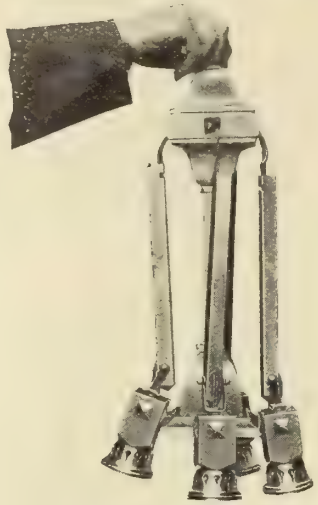
4060—250 Watt

The Jefferson Glass Company Limited

MADE IN CANADA

TORONTO CANADA

CONSOLIDATED TUNGSTOLIERS



¶ Cut shows the fixture as it comes from the carton.

¶ Note all shells, sockets and holders are attached.

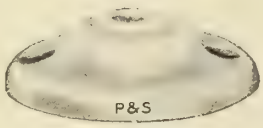
¶ No chance for missing parts.

¶ Write for your copy of Bulletin 150A, full details given.

The Tungstolier Company of Canada Limited

HEAD OFFICE: **212 King Street West, TORONTO**

New Outlet Box Rosette



P & S 1172
for 3 inch Boxes



P & S 1173
for 4 inch Boxes

Made of pure white glazed porcelain

Used as a box cover and fuseless rosette, combined.

Each carton contains the necessary screws to fasten to outlet box.

EXPENSIVE? NO.

Free samples and quotations gladly supplied on request.

Pass & Seymour, Inc.

Main Office and Works:
Solvay, New York, U. S. A.
San Francisco, Rialto Building

Sold by all Jobbers. Carried in stock by:

HALIFAX—John Starr & Son Co., Ltd.
ST. JOHN—St. John Railway Co.
QUEBEC—Mechanics Supply Co.
MONTREAL—Dawson & Co., Ltd.
TORONTO—Central Electric and School Supply Co.
WINNIPEG—Mainer Electric Co.
CALGARY—General Supplies, Ltd.
VANCOUVER—Cope & Son.

Cut this corner
Paste it in
Your note Book.

DUNCAN

Whenever
you are in need of
Electrical Supplies such as
Entrance Switches, Plug Cutouts
or *any* thing in this line

Remember——
That we make a specialty of these, and are in a position to serve you well with goods of

Duncan Quality

File this page with your Catalogs, or, better still, get one of our latest Catalogs, they are full of good things

TRADE DUNCAN MARK

There's your Guarantee.

Order through your jobber or direct from

The Duncan Electrical Co.
LIMITED
Montreal
Makers of Electrical Supplies

E Co D

Where QUALITY counts in

WIRES

AND

CABLES

SPECIFY CANADA BRAND

BARE and INSULATED WIRES,
RAILWAY and POWER FEEDER CABLES
in Copper or Aluminum.
COPPER TROLLEY WIRE
COPPER CLAD WIRE
(Duplex Metals)
GALVANIZED STEEL STRAND
GUY WIRE

Stocks of wire and cables carried at Toronto, Montreal, Winnipeg and Vancouver.

Canada
Wire & Cable Co., Limited

1160-1170 Dundas Street

Toronto, - Canada

Sales Agents:

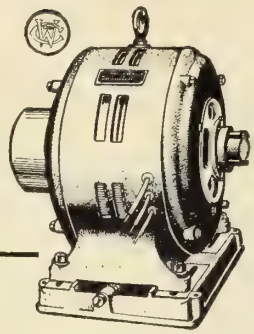
Roper, Clarke & Co., Limited
Montreal

A. E. Esling, Scott Block
Winnipeg

Macdonald, Marpole Co., Limited
Vancouver

Messrs. Gorman, Clancey & Grindley,
Calgary and Edmonton, Limited

We have a special line of ball-bearing motors designed to eliminate troubles due to seizing through dust and grit or through lack of oil, freezing in cold weather etc.



These motors have the smallest possible air gap and highest possible efficiency. Large stock of motors of all sizes for 25 cycle current carried in Toronto, ready for immediate shipment Over 50,000 H. P. in satisfactory operation, from Coast to Coast.

Standard Protected Type Squirrel Cage Induction Motor

Direct Current Motors

We also handle alternating current elevator motors, variable speed motors for driving printing presses, refrigerating machinery, etc. also small single phase motors with high starting torque.

Enquiries solicited for all classes of Electrical Machinery and apparatus.

Single and Polyphase

Manufactured from the best and most dependable material by the highest grade of English workmanship.

We can Supply any special design of motor that is particularly adapted to any class of work.

CHAPMAN & WALKER LIMITED

TORONTO - CANADA

Protection from Lightning Troubles

(MOSCIKI SYSTEM)

The following list of users of the Mosciki System of Lightning Protection speaks for itself:

Victoria Falls and Transval Power Co.
Shanghai Municipality.
Melbourne Electric Supply Co.
Cleveland and Durham Power Co.
St. John Del. Key Co. Brazil.
Societa Dergano.
Sociedad Espanola, Madrid
Societa Electrica Suburbana, Milan. &c.

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

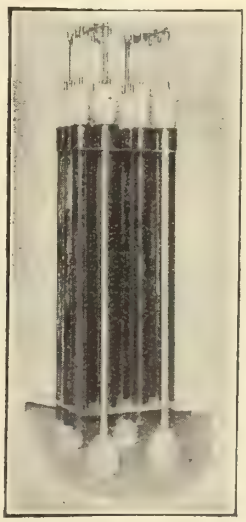
High frequency—not high voltage— is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use must offer a clear path to earth for high frequency currents independent of voltage.

The MOSCIKI System of Lightning Protection fulfils this condition absolutely — its principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

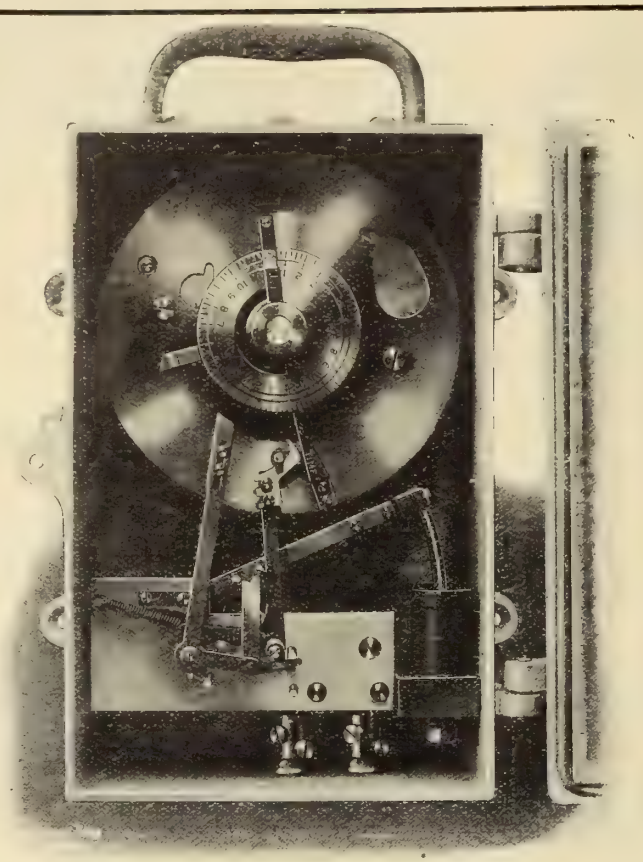
Mosciki Lightning Arrester



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CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS

116-118 Richmond Street W., TORONTO



TYPE "C"

"Venner" Time Switches

These high-grade instruments represent the highest attainment in British clock-workmanship and mechanical accuracy.

The "Venner" Time Switch is made in all types suitable for street-lighting, two-rate systems, signs, etc., and can be fitted with Sunday cut-out, later-hour and alternative day devices to suit your requirements.

Type "C" is suitable for controlling any current up to fifty amperes. The clock is of the six-weeks type with fully jewelled lever escapement including jewelled pallets and Breguet hair-spring.

In fact there is no better time switch to be found on the market than the "Venner."

C. & H. Meters

Single, Two and Three Phase Types

We have at our ware-rooms at 120 Richmond St. West, Toronto, a large supply of meters of all types from which we are prepared to make shipments at short notice.

We are meter and time-switch specialists.

Chamberlain & Hookham Meter Co., Limited

Toronto 120 Richmond St. W. Canada

Spencer & Aspinall

617 New Birks Bldg. Montreal, P. Q.

—: STOP :—

That's what you must do to read the following remarks, **BUT** it's what the **UNION** Motor **NEVER** does when once started and the current is kept on.

Learn all about it by asking for our Bulletins.

Canadian Union Electric Co., Ltd.

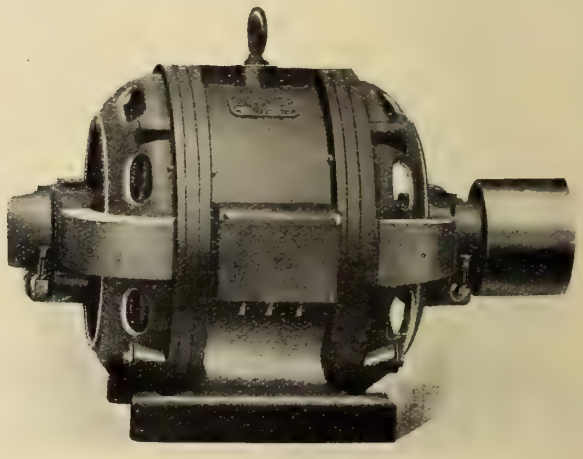
Head Office: 130 Wellington St. West, Toronto.

Also at 9 St. Nicholas St., Montreal.

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The Mainer Electric Company, Limited

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Pattern H. D. Squirrel Cage Motor.

How to Save Money on Underground Conduit Installations

Following are some of the advantages of J-M Fibre Conduit over tile conduit which makes the above possible:

Its light weight insures more rapid handling and a reduction in freight and trucking charges.

Sections are **54** in. and **60** in. long, so fewer joints are necessary. Alignment is taken care of at our factory so joints can be quickly and easily made without the use of cement or burlap—and no truing up is necessary.

Trench need not be made so wide or deep, so you save on excavation.

Breakage is practically nil because it is tough.

Skilled workmen are not required to lay it.



The Southern California Edison Co., of Los Angeles, Cal., installing 50,000 feet of 3½-inch Style "J" J-M Fibre Conduit on North Los Angeles St. running underground from East Fourth St. to the Plaza 15,000-volt cables to be used.

J-M FIBRE CONDUIT

is impervious to moisture, gases, water, acids, or stray currents, thus preventing electrolysis. In case of short circuits, no danger from fire.

This conduit has a smooth bore—no blisters or bumps to cause abrasions of the cable-sheath; therefore, pulling in of cables is easily accomplished.

Furnished with Bell or Straight Joints in four styles: Socket, Drive, Sleeve and Screw, together with fittings and bends to meet all conditions of service. Standard tubes **2** in. to **4** in. in diameter; Bell Joint, **54** in. long, and Straight Joint, **60** in. long.

Immediate shipment of J-M Fibre Conduit can be made on rush orders. This is made possible by the very large stocks we constantly carry.

Our book on J-M Fibre Conduit contains FULL information. Write our nearest House for a copy.

THE CANADIAN H. W. JOHNS-MANVILLE CO., LTD.

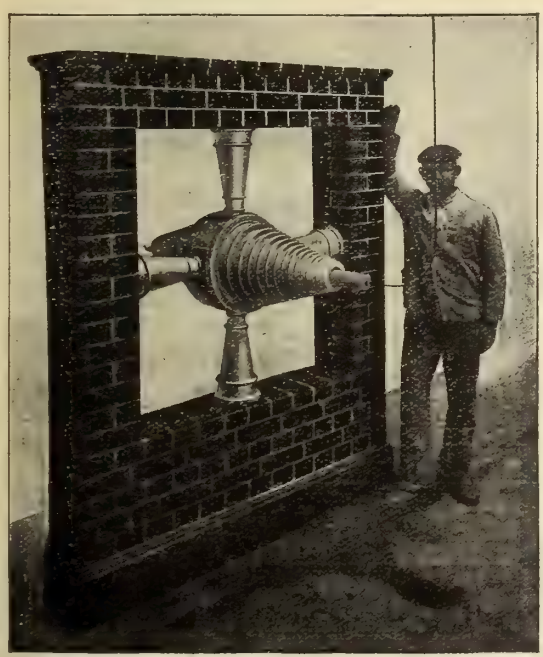
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Wall Duct for the High Tension Transmission Station of the

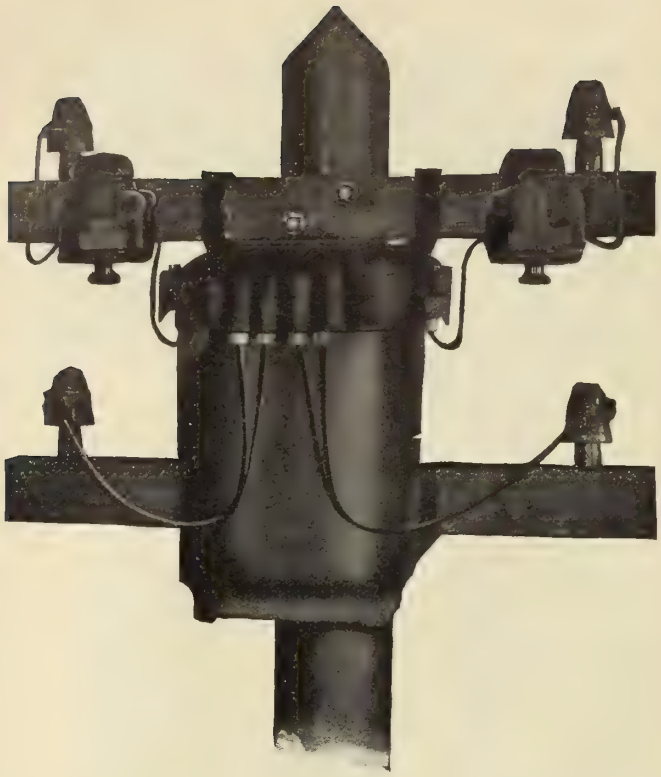
Hydro-Electric Power Commission of Ontario

110,000 Volts

Sole Agents for Canada

Watson Jack & Company

709 Power Building, MONTREAL



Operating Expense Greatly Reduced

DID you ever stop and figure your transformer cost?

Not the cost of purchase and installation, but the cost of upkeep and core and copper loss.

Moloney Transformers owing to the high grade Silicon Steel used in their core and to their perfect design have reduced core and copper loss to a minimum.

Moloney transformers will effect a saving of 20 per cent. in one year over ordinary transformers and in five years the price of a new transformer. This is not an empty statement but a proven fact.

Send for our illustrated catalogue.

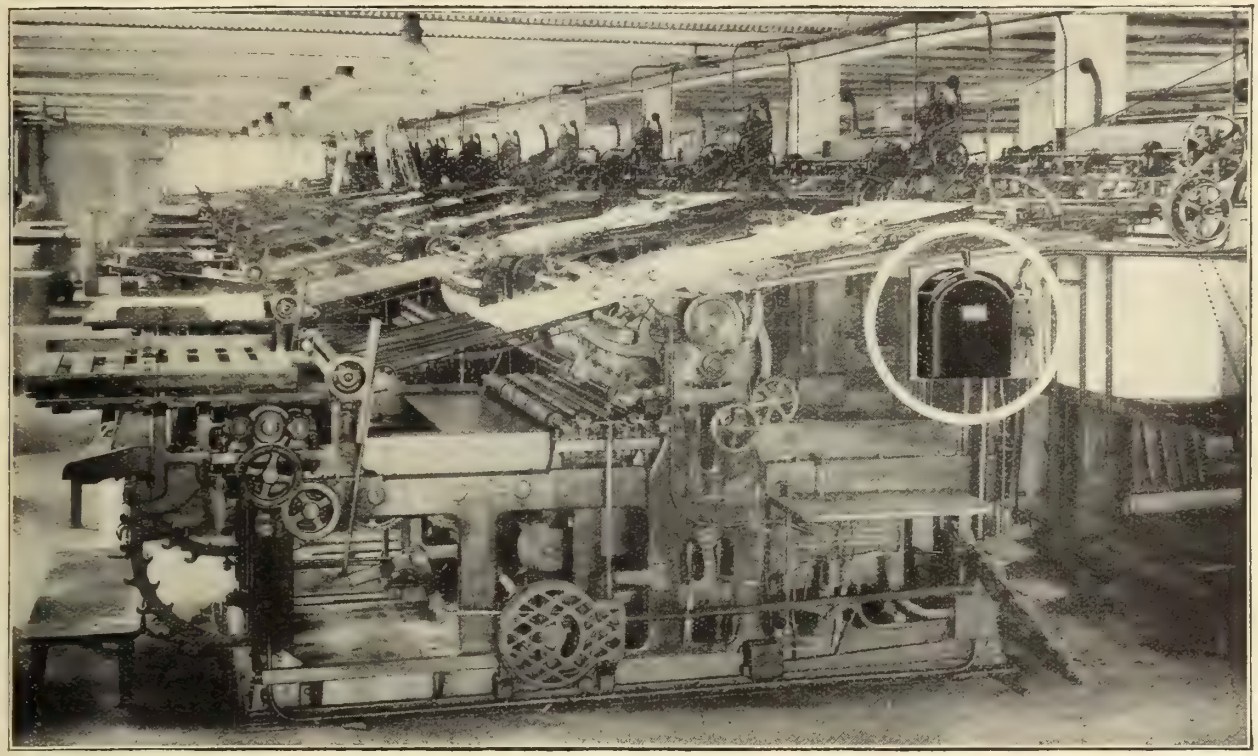
Canadian Moloney Electric Co., Limited

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901 New Electric Railway Chamber, Winnipeg, Man., Can.
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Complete Stocks at **Windsor, Winnipeg, Vancouver**

CUTLER-HAMMER



Row of flat bed presses in the Charles Schweinler printing plant equipped with Cutler-Hammer "Carpenter" Controllers. In this plant there are also 35 Cutler-Hammer "Kohler System" Controllers besides 42 other Cutler-Hammer Starters and Regulators.

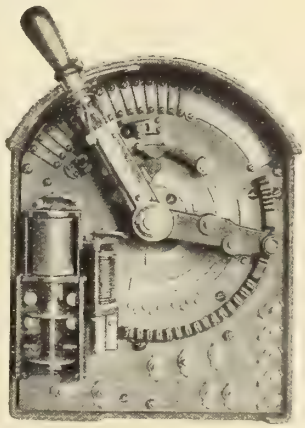
A Row of Good Presses

Equipped with

Carpenter Type Controllers

Wherever printing is done Cutler-Hammer Carpenter type Controllers are known. These controllers, now made in many styles for D.C. systems and a new one for A.C. systems, were the first to give the accurate, convenient and reliable control of motor-driven flat bed presses.

A newly organized "Printing Equipment Department" offers you the result of 20 years' experience in the selection of manually-operated and automatic controllers for use with all kinds of motor-driven machinery used in the printing plant. Put your controller problems up to CUTLER-HAMMER.



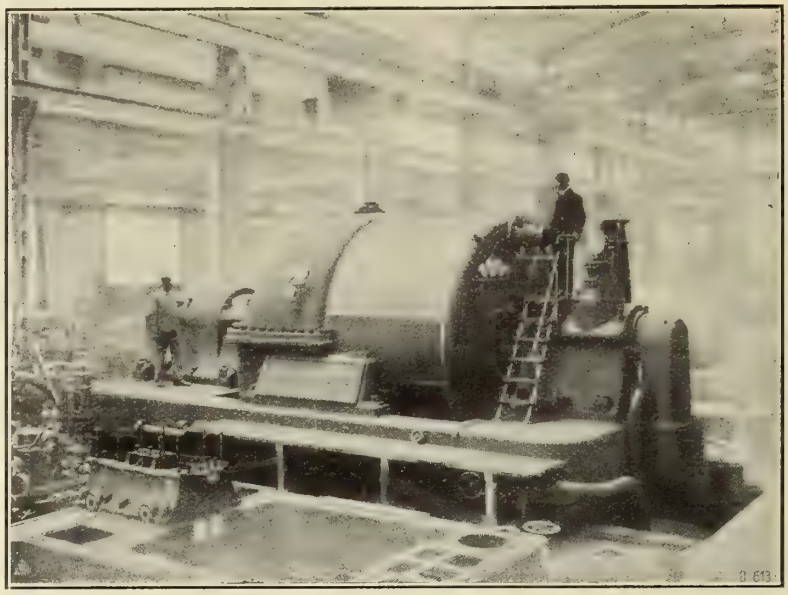
Interior view, showing compact, substantial construction of Cutler-Hammer Carpenter type controllers.

Printing Press Controller Bulletins sent promptly on request.

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

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BOSTON: 176 Federal Street PHILADELPHIA: 1201 Chestnut St. CLEVELAND: Schofield Building
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28,000 H. P. Zoelly Steam Turbine

Zoelly Steam Turbines

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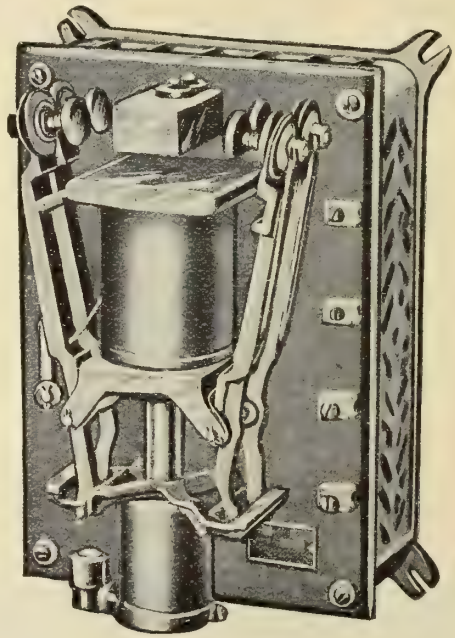
SUNDH SOLENOID MOTOR STARTERS

Compact and reliable starter for Direct Current. No sliding contacts.

The advantages of this type of construction are not only simplicity and easy replacement of wearing parts, but also the elimination of sliding contacts which cause trouble due to arcing and consequent sticking of the moving member.

The construction of the Sundh Automatic Starter is compact and simple, consisting of a solenoid, a plunger with retarding dash-pot, and two or more levers hinged to the lower pole-piece of the solenoid.

Send for illustrated Catalogue on Electrical Controlling Devices



The upper ends of the levers carry the contacts. The levers are controlled by their lower ends passing through a frame which is attached to the bottom of the plunger. The contacts are of copper and carbon, and all wearing parts are accessible and easily replaced. For heavy duty the final contact is made by a laminated copper brush. This copper brush, however, does not cut out any resistance, but merely short-circuits the carbon contacts which do cut out the resistance.

SUNDH ELECTRIC CO., NEW YORK, U.S.A.

KEEP DOWN THE COST

Isn't that just what you are trying to do all the time? You are forced by economic pressure to buy in the cheapest market. Have you figured that ALUMINIUM Busbars, Rod-Connections and Strip will efficiently replace Copper and save you upwards of 5 cents on every pound of material?

Let us send you our Bulletin No. 133 it tells the whole story.

THE BRITISH ALUMINIUM COMPANY LTD. (OF LONDON, ENG.)

60 W. FRONT STREET - TORONTO, CANADA



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
Second, because it is the only renewable fuse that is uniformly rated.
Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
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Special Announcement!

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

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ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.

What is Cleanezy?

IT'S A NEW ONE

Our new catalogue on the

Holophane-D'Olier Metal Reflector Line

will tell you and acquaint you with the most complete line of Steel and Porcelain Enamel Reflectors made.

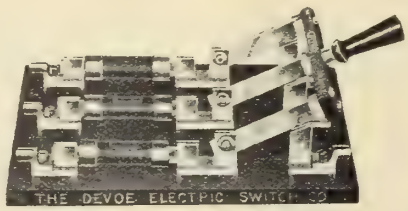
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The Holophane Co., Ltd., Toronto, Can.

The Devoe Electric Switch Company

Manufacturers

We design and manufacture, Switchboards, Panel boards, Cabinets, Switches and Iron Boxes of every description.
Quotation promptly made upon request when drawing or sufficient data are submitted.

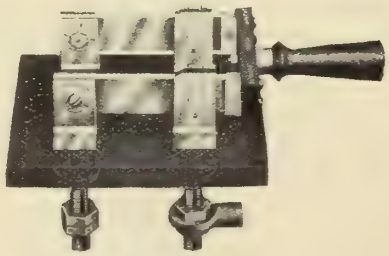


Cut No. 343

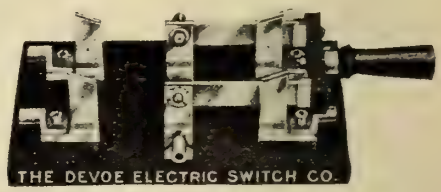




Cut No. 2005



Cut No. 268



Cut No 205

Write for catalog No. 6. *Send us your specifications.*

OFFICE and FACTORY, 157 Craig St. West, MONTREAL

G. M. Gest

Conduit
Engineer & Contractor

503 Power Building, Montreal, Can.



NEWTYPE
BERGMANN
LAMPS

(*Tungsten Filament*)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO., LIMITED

329 CRAIG STREET WEST
MONTREAL, P. Q.

LIVE AGENTS WANTED ALL OVER CANADA

There is Profit for You in Reflectors that Satisfy



STORE

For Residences and Stores

We recommend the well known "Holophane" Reflectors. Their design combines practical use with artistic arrangement. They are especially adapted to Haberdashery or Departmental Stores where it is so neccessary to have just the right distribution of light to show off fabrics to best advantage.

From the wide range of styles, many lighting combinations can be secured. Each is designed to meet a specific requirement.



STORE



FACTORY

For Industrial Lighting

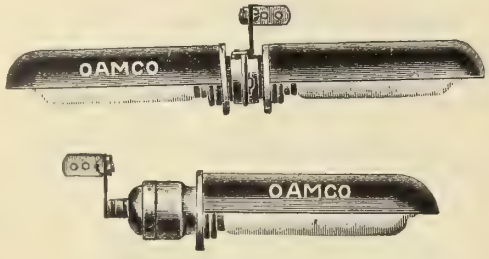
Benjamin Reflectors form an important factor in the lighting arrangements in many of the largest factories in Canada. Right in your territory you will find a profitable field among the various industrial concerns, the majority of which have poor artificial illumination. Make a list of these and see that they are systematically canvassed.



RESIDENCE

For the Show Window

The value of many otherwise effective window trims is lost by improper methods of artificial illumination. Reflectors such as are here illustrated, are specially constructed to give the best results—hence our recommendation.



SHOW CASE



SHOP

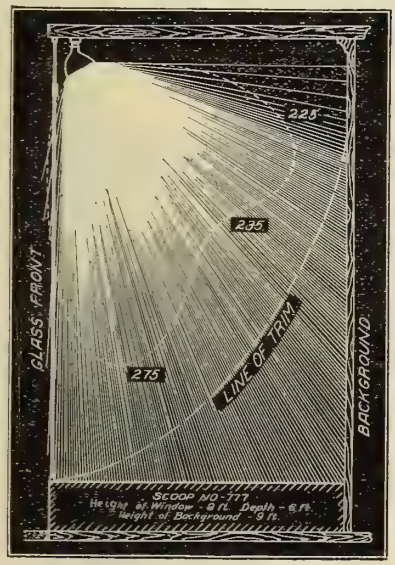
THE Northern Electric AND MANUFACTURING CO. LIMITED

Manufacturer of Telephone and Fire Alarm Apparatus and Distributor of Electrical Supplies for every possible need.

Montreal	**Halifax**	**Toronto**	**Winnipeg**
Regina	**Calgary**	**Edmonton**	**Vancouver**

The "Scoop," one of five X-RAY reflectors designed to efficiently light store windows, is unquestionably the most popular reflector ever produced. Canadian jobbers sell X-RAY reflectors





Cross section of window showing distribution of light from Scoop with 60-watt Mazda lamp.

X-RAY reflectors operate on the searchlight principle.

In railroading at night a powerful beam of light is wanted, on the track, ahead of the locomotive. To accomplish this the light rays must be controlled.

In selling-by-display during the evening hours, a brilliant, uniform flood of light is wanted on the goods and from concealed sources. This also requires control of the light rays.

No matter what the window lighting problem may be, there is an X-RAY reflector especially designed to illuminate that window without wasting any light on ceiling or sidewalk—without blinding people who want to see the merchandise.

Thus, a high, shallow window requires X-RAY "Helmet" reflectors; the nearly square window requires "Scoops"; the low, deep window calls for "Poke Bonnets"; the window with glass or polished background necessitates "Visor" reflectors; the very small window is ideally lighted with "Midgets."

This is efficient window lighting. Our booklet "Show Window Searchlights" covers the subject fully. Send for a copy.

NATIONAL X-RAY REFLECTOR CO.

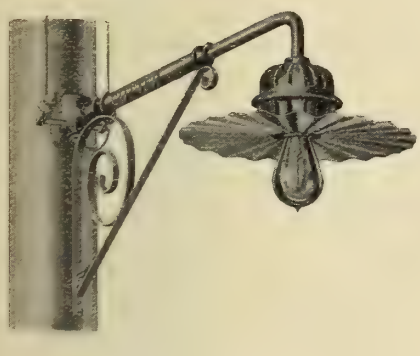
General Offices,
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Make Yours "THE CITY BEAUTIFUL"

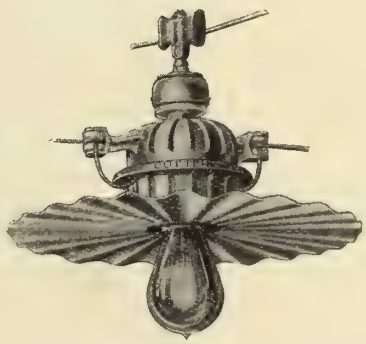
- - Install - -

CUTTER STREETHOODS



Cutter Boulevard Telescope Bracket with One-Piece Fluted Streethood.

Substantial Construction
High Insulation
Easy to Install
Artistic Appearance



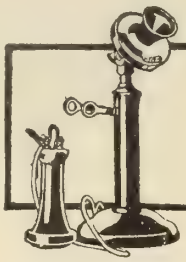
Style G—High Voltage Cable Grip Suspension Streethood.

The body of our new type streethood is a reinforced porcelain insulator designed to receive series or multiple sockets. The fluted steel reflector is fire enameled—blue on top and white on the reflecting surface.

Write for Catalog No. 12

GEORGE CUTTER COMPANY, South Bend, Indiana, U.S.A.

423 Notre Dame Street



SAFEGUARD
YOUR SERVICE

THERE are more than 500 telephone "troubles" in Jacksonville every day due to telephone receivers being left off the hook.

Your telephone is reported "Busy" or out of order when the receiver is left off the hook, no one can call you and you are likely to suffer serious inconvenience.

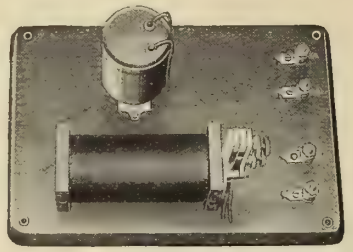
On duplex and party lines all telephones on the line are rendered useless when any one of the receivers is left off the hook.

When you receive a call for a person who answers at an extension telephone, see that your receiver is replaced as soon as the telephone is answered.

Watch your telephone, see that employees are careful to replace the receiver, your service will be improved and you will aid us to increase the efficiency of the service throughout Jacksonville.

May we have your co-operation?

SOUTHERN BELL TELEPHONE
AND TELEGRAPH COMPANY



Safeguard Your Service

BUY A HOWLER

Spare your subscribers and yourself delays due to receivers being off the hook

The Kellogg howler (illustration above) is one of our standard induction coils with interrupter and condenser mounted on a nicely finish, oak panel.

It can be screwed up on the wall or set horizontally on a table or on the switchboard.

It is connected to the line through cord and plug at the board. Simply insert the plug in the jack "of the offending party" and work the key. A good lively "howl" is the result. If desired the apparatus can be connected to the wire chief's desk and he can do the signalling without carrying through the board.

Settle this "receiver off the hook" annoyance with dispatch. Buy a howler.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

MAIN OFFICE AND FACTORY: CHICAGO

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DEERING ELECTRIC LIMITED, REGINA, SASK.
HOUSTON & COMPANY, LIMITED, WINNIPEG, MAN.
B. C. HOLST & COMPANY, VANCOUVER B.C.



Peirce Clamp Pins Strengthen Cross Arms

instead of weakening them. Even if your cross arms are already drilled for ordinary wooden pins, you can lengthen their life by using Peirce Clamp Pins.

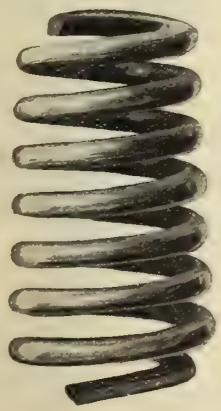
Recently a Central Station Superintendent inspected a lot of cross arms which had failed in service and had been replaced by new arms. Of approximately one thousand arms in the lot over seven hundred and fifty were found to have merely split, and these were put back into service by using Peirce Clamp Pins which bound the fibres together.

Tests showed that these reclaimed arms when so equipped were stronger than new arms with wood pins.

The pins are rolled out of open hearth steel, properly designed for the exacting demands of modern service. The heavy coat of hot galvanizing gives full protection against rust.

Isn't it perfectly evident that, whereas a cross arm is seriously weakened by drilling holes for ordinary pins, it is bound to be stronger when clamped with steel bands such as those used in installing Peirce Clamp Pins?

Remember that a locust pin loses 40 per cent of its strength the first year, while the Peirce Clamp Pin lasts forever, and will carry an 800 lb. strain without deflection. All Peirce Clamp Pins are equipped with



The Peirce Spring Thread

which allows for expansion, contraction or inequality of bore, yet holds the insulator securely at all times.

In hot weather, it elongates and creeps further up in the insulator thread, preventing destructive pressure on the glass—in cold weather it still keeps closely in contact, and the insulator can't wobble.

Its resilfiency is another advantage, helping to absorb sudden jerks or strains to which the wires might be subjected.

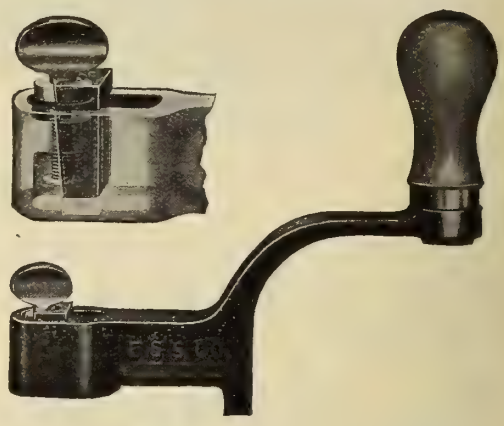
Peirce Specialties and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.

The Hardware MAKES the Line, Hubbard Makes THE Hardware

Hubbard and Company, Pittsburgh, U.S.A.

No More Loose Controller Handles

Put this handle on the shaft, give the thumb screw a turn—this forces the wedge down—and the handle is securely locked to the shaft.



The "Lock-On" Controller Handle

when once applied to the shaft is there to stick until the motorman takes it off. It can't come off in an emergency. It can't work loose.

The "Lock-On" Handle enables each point to be taken properly, so reducing arcing inside the controller; it prevents wear on a new shaft; it has sufficient adjustment to take shafts either oversized, undersized or badly worn, and it is interchangeable on all controllers of a given type.

A properly fitted controller handle is not a fad—it is a real necessity.

Wouldn't it be worth your while to ask for a sample?

JOHN MILLEN & SON, LIMITED
Canadian Distributors
TORONTO MONTREAL WINNIPEG VANCOUVER

ELECTRIC SERVICE SUPPLIES CO.
Manufacturers
PHILADELPHIA 17th and Cambria Sts. | NEW YORK Hudson Terminal | CHICAGO 417 So. Dearborn St.

JUDGE BY RESULTS—NOT BY COST

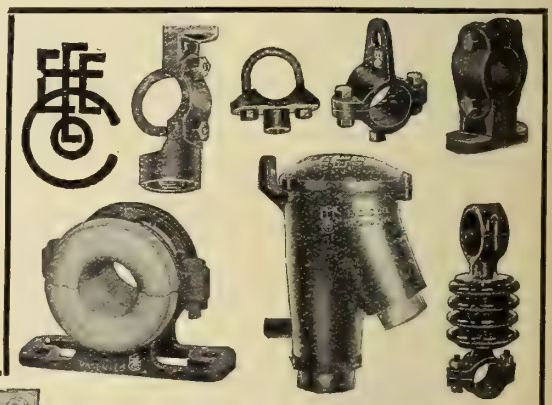
Outdoor Pole Top and Station Disconnecting Switches in all capacities and voltages, Bus Bar Supports, Cable End Bells, Switchboard and Pipe Frame Fittings, Clamp Insulators, Station Pins and other Station and Transmission Specialties.

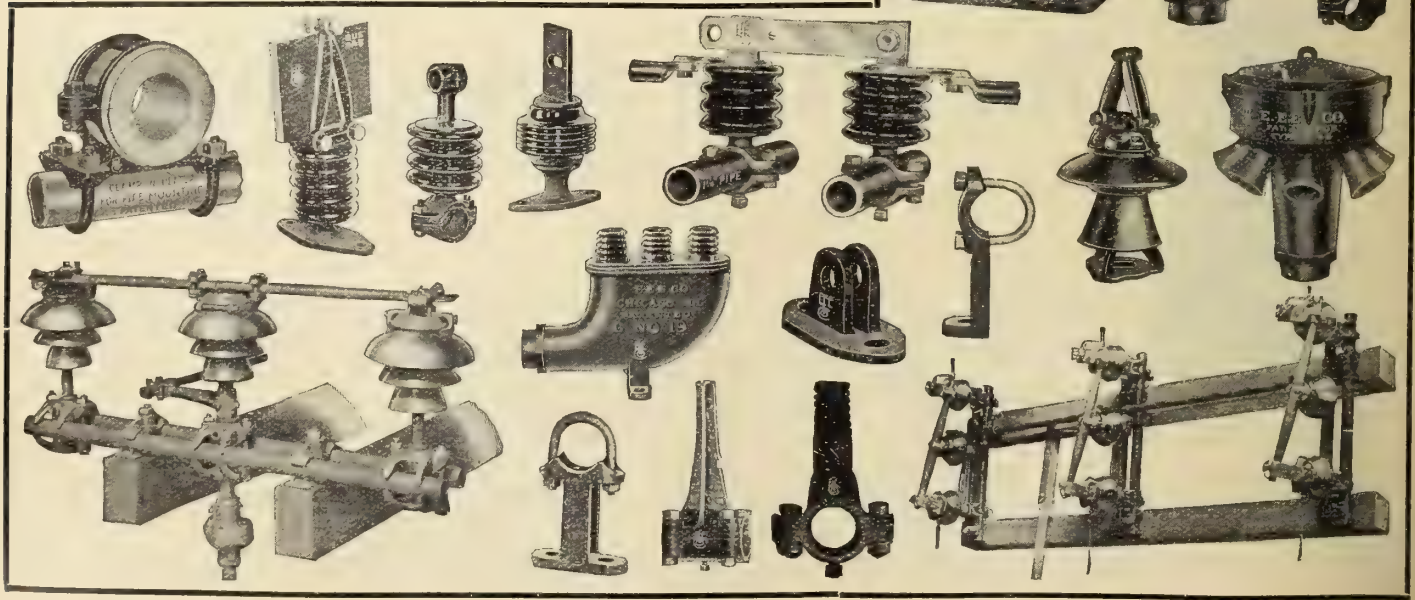
All designs based on expert knowledge of exact service conditions and is the product of selected materials and accurate workmanship.

A five-year positive guarantee upon all our products assures you of our responsibility.

Send for our Blue Catalogue and Pole Top Switch Bulletin 100.

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Electrical News
Generation, Transmission and Application of Electricity

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The Society for Electrical Development

The convention of the Society for Electrical Development held at Association Island, Lake Ontario, September 3-6, was a decided triumph for the gospel of "Co-operation." Dr. Steinmetz was only one of the many to voice the sentiment that competition as an economic and industrial force is dead, and that co-operation has taken its place. The existent opinion that the process of consolidation which is so noticeable now-a-days in the various industries is destroying competition, is wrong. It is the recognition of the fact that competition is a useless waste of time and energy that has been the cause of the consolidation. In the electrical industry this has been forcibly illustrated by statistical figures which go to show that only some 15 per cent. of the possible business in the United States has been developed. In Canada the percentage would probably be even lower. It is clearly the height of folly that all the existing selling organizations should be carrying on an expensive competitive campaign for this 15 per cent. while the 85 per cent. lies dormant. It is to remedy such a state of affairs that the Society of Electrical Development has been formulated.

As further verification of the above statement of the vast undeveloped fields of electrical operation we quote the opinion of Mr. Frank A. Vanderlip, president of the National City Bank of New York, whose address before this association was calculated to emphasize the tremendous financial demands certain to be made by the electrical industry in the immediate future. Mr. Vanderlip places the weekly demand for the next five years at $8,000,000 of capital or $400,000,000 per year. This surely is a more virgin soil in which to plant a salesman's efforts, than the 15 per cent. which has long shown signs of being over-cropped to an unprofitable degree.

Electrical Securities as Investments

As president of the National City Bank of New York the expressed views of Mr. Vanderlip, before the Society of Electrical Development, on the value of electrical securities as desirable investments, were heard with satisfaction by all electrical men present. The speaker pointed first to the comparatively small percentage of investors who have in the past cared to risk anything in electrical securities. These he places at 20 per cent. or less and gives as explanation (1) the fear of some new invention upsetting all financial calculations and (2) the often unfavorable relations regarding charters, rates, taxes, etc., which exist between private companies and the municipalities in which they operate. Mr. Vanderlip added, however, that "the time has now come, in my opinion, where no man with capital to invest in corporate securities, if he has a desire for return that is any larger than government obligations will pay, can longer hold back from the study of public utility investments."

It is probable that a more opportune moment than the present has never existed in Canadian history in which to formulate a judgment on the ability of public utility securities to withstand the onslaught of hard times and tight money. In reviewing the proceedings of the stock markets for the last six months, serious recessions in the prices of electrical securities are almost conspicuous by their absence. This, too, it must be noted, is in the face of the fact that many of these industries are young and far from mature. The explanation is not far to seek. The various phases of the electrical industry, such as street railway operations, electric lighting, etc., represent, from the very nature of the service they supply, a continuity of operation and stability of revenue not found in other lines of industrial development. The electrical investor especially should bear these advantages in mind. By patronizing his own securities he will not only assist in establishing the confidence of the general public but he will reap a good financial return himself.

Exhibit of Electric Trucks

A noteworthy feature of the Vancouver Exhibition parade held on the opening date, September 1st, was the electric trucks division, organized by the B. C. Electric Railway Company, at whose garage nearly all the electric vehicles owned in the city are stored. The division was led by the company's tower wagon mounted on a 1-ton chassis, followed by a fleet of trucks operated locally by this concern, comprising a demonstration truck weighing, 3½ tons; construction truck, capacity 2 tons; arc light wagon, capacity 750 pounds; and a meter wagon of 1,000 lbs. Next in order came the trucks owned by prominent Vancouver wholesale firms. These consisted of a 5-ton truck owned by Kelly Douglas & Company, wholesale grocers, which has been in constant daily operation in the city for over 5 years and is still giving satisfactory service; the Dominion Fish Company's 1-ton delivery wagon, which has been successfully operated for the last 3 years; a 1-ton truck owned by the wholesale hardware firm of McLennan, McFeely & Company; the Brackman-Ker Milling Company's 2-ton truck; a 2-ton truck operated by the Rainsford Company, wholesale fruit merchants; and a 2-ton truck in the service of Wood, Vallance & Leggat, wholesale hardware merchants. Occupying a position at the rear of the division was the chassis of a 750 pound delivery rig, the works of which were purposely left uncovered to demonstrate how simple is the operation of an electric truck. All vehicles were decorated with banners advocating the economy and satisfaction which is guaranteed by the use of electric trucks.

A great deal of interest was evidenced by the general public in this display, the first of its kind to be held in Vancouver and the organizers are of the opinion that as a result

of the publicity gained, the sales of electric vehicles should be stimulated throughout the province. Among the exhibits of the B. C. Electric Company at the Vancouver exhibition was a splendidly equipped electric bus recently disposed of to the Lotus Hotel, of this city. This is the second hotel bus sold by the company since January 1st of this year, the other one having been purchased by the Dunsmuir Hotel.

Other units included in the company's exhibit were an



Electric truck parade in Vancouver.

electric pleasure vehicle manufactured by the Standard Electric Company; rotary convertor for use in charging electric vehicles in private garages; vibrating rectifier for charging ignition and lighting batteries from household circuits; an electric vulcanizer utilized in repairing automatic tires, and in addition a full line of appliances used in connection with electric vehicles.

An Encouraging Sign

A complimentary reference was made by Mr. M. B. Cotsworth in his minority report regarding the wages dispute, to both Mr. R. H. Sperling (general manager of the company) and the representatives of the employees. Mr. Cotsworth says:—"The well recognized ability and fairness of the general manager is manifest by the authority given him by the company, and the fact that during the months this dispute has been maturing, not a single detractive word has reached me from any of the hundreds of employees I have met, but on the contrary they have expressed confidence that so long as they could be assured that he had freedom to do right, they could rely upon getting justice from him, because his past decisions had been fair, whenever they were permitted to lay their cases before him personally."

"Similarly the board of conciliation was unanimously convinced of the ability and fairness of the local president of the employees' association and his henchmen, who rightly hold that the men's capital employed as personal energy is as essential to the success of the company as is the electrical energy, machinery, cars, etc., purchased by the shareholders' outlay."

Electricity in India

The conversion from steam to electric drive of a large number of cotton mills and factories by the Tata Hydro-electric Company will shortly be taken in hand. The contract for this important work has been entrusted to the British Westinghouse Company, whose staff and machinery are now due in Bombay. The motors will all be of the Westinghouse "AIF" slipring protected type, suitable for double drive, and for 3-phase current, at 2,000 volts and 50 periods. At present a total of 207 motors of this type have been ordered, the sizes ranging from 50 to 500 brake horse-power. The motor speeds are 290 and 365 revolutions per minute, there being several of each horse-power capacity at these speeds. With regard to the drive, the motors will be coupled direct to the line shaft in a great majority of cases without the intervention of counter shafting. The motor switch pillars are of the Westinghouse ironclad type "S" pattern, which are now being largely used in mining and other industrial work, the starting being effected by liquid controllers. The transformers are 3-phase, oil-immersed, self-cooled units, and reduce the supply from 6,000 to 2,000 volts kv.a. from the motor. They number 64 in all, and are of four sizes, namely, 22 of 500 kv.a., 14 of 600 kv.a., 21 of 700 kv.a., and 7 of 900 kv.a.

The Montreal Harbour Electrification

The enormous increase in the work of the Montreal Harbour Commissioners, especially by the extension of grain storage, has resulted in the greater use of electrical power. According to the report of Mr. T. E. Salter, chief electrician to the Commissioners, about 5,000 horse-power in motor load and 2,500 incandescent lights, fed from power from Nos. 2 and 3 sub-stations, were added to the system during the 1912 season.

The plant is electrically driven throughout by 3-phase 60-cycle, 550 volts, squirrel cage induction motors, the units ranging in size from 5 horse-power to 150 horse-power. No. 1 station feeds and controls for No. 1 grain elevator, 1,000 h.p.; for conveyor galleries, 1,785 h.p; No. 2 station feeds and controls for No. 2 grain elevator, 3,435 h.p.; and for conveyor galleries, 1,250 h.p., a total of 7,470 h.p. The system is lighted by approximately 2,000 incandescent lamps and 15 arc lamps.

The current is delivered by the Montreal Light, Heat & Power Company from their underground system to No. 1 station at a pressure of 2,500 volts. This is stepped down through three 300 kv.a. and two 375 kv.a. self-cooled, oil-insulated transformers for power, and through three 10 kv.a. and two 20 kv.a. self-cooled, oil-insulated transformers for 110 volts multiple and 440 volts series lighting respectively. The power is received at No. 2 station at 2,500 volts, similar to No. 1, and this is stepped down through three 1,000 kv.a. water-cooled, oil-insulated transformers for power, and through three 25 kv.a. self-cooled transformers for 220 volt multiple lighting. The main feeders are carried from the low tension switchboard to power panels located on the different floors of the elevator and in the towers of the conveyor system.

There are three distinct telephone systems in use, for No. 1 elevator, for No. 2 elevator, and for the conveyors. For the latter there is a telephone in every tower, in each shipping gallery, and one in each of the elevators and sub-stations. The tower stations consist of a standard telephone giving communication with the other towers and elevators. The gallery stations consist of a number of telephone jacks placed at ship loading spouts, and vary between 14 and 19 in different galleries. Each of the elevators has an independent signal system consisting in one case of annunciator drops and numbers, or with annunciator drops numbered, used for starting and stopping apparatus and in the other case of red, green and blue lights used for automatic weighing of grain. The conveyor galleries have a system of signals designed to operate a bell and light in series. These signal lights are numbered and correspond to the belt from which the signal is sent, signals from No. 1 elevator appearing on red globes, and signals from No. 2 elevator appearing on green globes. In order that grain from No. 1 and No. 2 elevators may not be sent on the same belt at the same time, and thus cause a grain spill, an interlocking system is installed in this portion of the conveyors, and, acting through a system of relays and push-buttons, prevents the

energizing of the signals from any other source than the first given. These remain set until the shipment is complete and the line restored to normal position.

An underground system carrying power and light cables has been commenced from Victoria Pier and a number of ornamental arc lamp standards have been erected on the high level wall on Victoria Pier and also between Victor and Berri Street subways. Current is supplied from No. 2 Station for these arc lamps as well as for the lighting up of the subways. These lamps are of the regenerative yellow flaming type, of about 2,500 candle power each.

The new wharf offices situated on the west side of No. 1 elevator are equipped with fittings mostly of the pendant chain type, with a few 4-light fixtures where occasion required, the halls and porches being fitted with the opalescent ceiling type. The offices are illuminated with 40 and 60 watt tungsten lamps, current being supplied from an underground circuit fed from No. 1 station, which enters the main distributing panel in the basement of the offices. Railway companies who have leased offices in the same building, are also supplied with the same current through separate meters. The total power consumed and the cost of same during 1911 and 1912 in No. 1 elevator were:

Year	Total Power Consumed	Cost
1911	981,399 h.p. hours	$15,241.64
1912	1,011,572 h.p. hours	15,285.92

During the present year No. 2 elevator has been constructed, and the electrical equipment has been described in the Electrical News. An addition to No. 1 elevator is now in process of being built, and this will necessitate an addition to the transformer station and plant and its re-organization. This work, however, will not be carried out completely until the close of navigation.

Flexible Frame Tower Line

Transmitting Power from Decew Falls to Bartonville, Hamilton

By Mr. C. H. Hutton

The first flexible "A" frame transmission line to be built in Canada has now been in successful operation for a year's time. This interesting line, forming a part of the extensive 45,000 volt transmission system of the Dominion Power & Transmission Company of Hamilton, Ont., is 31.6 miles in length, and is one of three main trunk lines connecting the open air switching station at Bartonville with the generating station at Decew Falls.

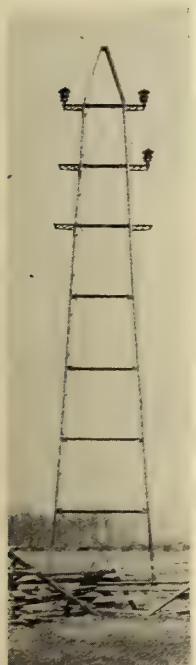


Fig. 1.—Typical tower.

Since the completion of the main line this company has built several shorter lines using the same construction. The line is built on a private right of way 33 feet wide, for the greater part paralleling concession roads or railways. This has proved an immense advantage, both in construction and for patrol purposes. One triangle only is strung at present, there being room for two ultimately on the one tower line, and room on the right of way for two lines.

An excellent idea of the neat appearance of this type of construction is had by referring to figures 1 and 2 which show a portion of the line where it parallels the Toronto, Hamilton & Buffalo Railway. As will be seen, the tower has only two legs, each of which is composed of standard 7 in. No. 9.75 channel. The legs are in one piece and are connected together by a system of ⅝ in. round bar latticing and 2¼ x 2¼ x ¼ angles, so that there is no thin metal whatever, and hence no need for the customary and expensive galvanizing. The sides are slightly curved, giving the tower a very graceful appearance. The arms are malleable



Fig. 2.—Special 57' 'A' frame towers.

castings bolted to the 7 in. channels, as are the steps on one side.

The footings are composed of two pieces of channel placed at right angles, clearly shown in Fig. 4; the upright piece or stub is heavily galvanized notwithstanding its thick section being 8 in. No. 11.25. The footing is carried well above the ground line so that the tower possesses maximum section and resistance to corrosion at this vital point. The towers are shipped from the factory assembled complete, with the exception of the arms, 12 on a flat car. This is an immense advantage, as all joints are rivetted at the shop,

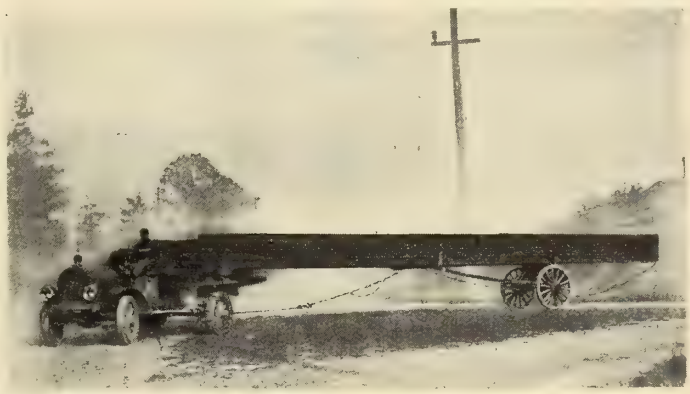


Fig. 3.—Motor made 12 trips daily, 4 towers each trip.

and all field work in assembling done away with beyond the bolting of the arms and steps in place. At corners and for railway crossings towers of identical construction but heavier section were used. These towers, and one every half mile on tangents, were guyed to scrap rail anchors buried 6 feet deep in the earth. Suspension strain insulators, as well as the ordinary pin insulator, were used on these structures as may be seen in Fig. 4. Two split lock nut washers were used on the insulator bolts, one at each end. These proved great time savers in aligning the insulator grooves with the conductor.

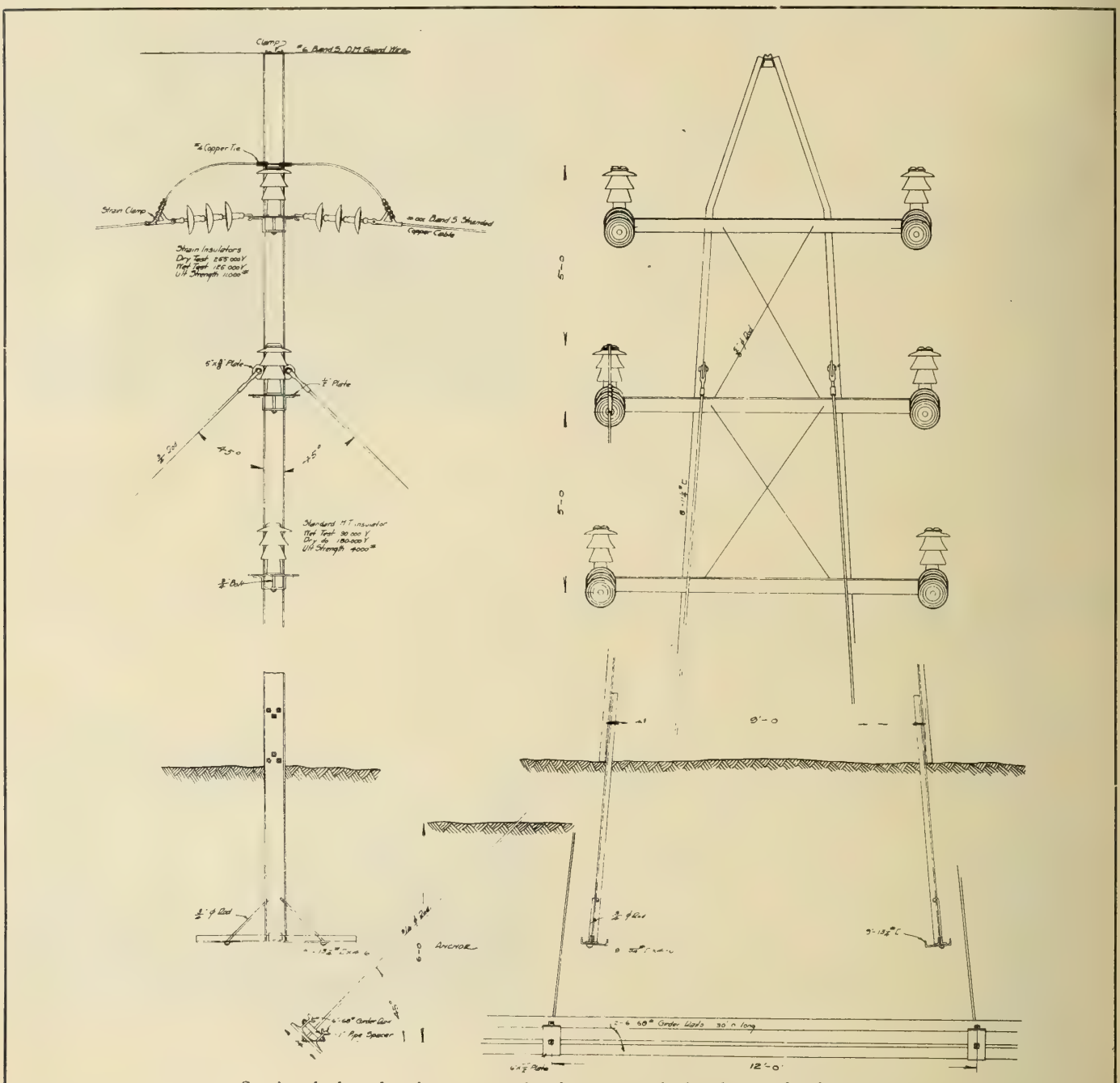
The speed of erection of the towers was a revelation to many who were familiar only with the length of time taken

to assemble and raise the old style 4-leg windmill type of structure. Some idea, however, can be gained when it is stated that an erection gang composed of 1 team and 6 men on average ground could erect 4 towers an hour with ease. When a tower was erected it meant that it was ready for the copper, as the insulators, arms, etc., were all placed and adjusted before raising.

The delivery of all material was accomplished by auto truck and some towers raised by this means. Fig. 3 shows the truck equipped with trailer hauling 4 standard 47 ft. towers from the railway delivery station. The truck was worked day and night and made an average of twelve trips a day with 4 towers to a trip, the longest haul on the line being 12 miles from the railway. The truck was purchased for this job and sold at its completion, paying for itself and showing a handsome profit on the transportation estimates.

The conductors are composed of six No. 6 B & S gauge, M. H. D. copper strands around a hemp core, and are pulled up to an 11 ft. sag in standard spans of 400 feet between towers. The longest span on the line is 750 feet, where the line goes up the Niagara escarpment some 250 feet. The construction proper commenced June 1st, 1912, and the line was in service the following November.

From carefully prepared estimated and actual construction costs, the relative economy of this type of line compared with 4-leg towers of equal weight, is as follows:



Sectional plan showing towers, insulators, strain insulators, footings, etc.

	4-Leg	"A" Frame
Cost of towers on cars	100%	85.7%
Sub-delivery	100%	93%
Assembling	100%	6%
Foundation	100%	62%
Erecting	100%	19.5%
Stringing	100%	115%

The line was built complete under the supervision and direction of the company's own engineering staff and construction department. The various contracting firms were

as follows:—towers, Archbold-Brady Company, Syracuse; foundations, Hamilton Bridge Works Company; insulators, Thomas Insulator Company; strain insulators, Ohio Brass Company; hardware, Ohio Brass Company; brackets, McKinnon Dash Company, St. Catharines; motor truck, Monarch Motor Car Company, Hamilton; conductors, Standard Underground Cable Company, Hamilton; Eugene F. Phillips Company, Montreal; graphite paint, Dominion Paint Works, Limited, Walkerville.

Central Station Opportunities

The Electric Vehicle the Greatest—Paper before N. E. L. A. Convention

By Mr. E. E. Witherby

The biggest piece of real business in every man's community in the transportation of persons and merchandise and at least fifty per cent. of all the tonnage that you see every day can be hauled cheaper by electric vehicles than it can be done by horses or gasoline machines.

The pleasure car salesman has a hard up-hill job to convince the man or woman who wants a simple and elegant vehicle for personal use, to buy an electric. The electric truck salesman has a hard job to influence the merchant or warehouseman in the purchase of electric commercial vehicles, when the officers and superintendent of the electric company are all driving around in gas cars and are using horses and gas trucks for the work of the central stations. And, let me emphasize the fact that this is not an idle statement; on the other hand, it is the usual condition, I am sorry to say. Now, I am not taking every central station man to task on this—there are a few who realize the opportunity and are honestly trying to help the electric vehicle and in this way help themselves for a big record of increase in business and their stockholders to dividends; but the small percentage of the whole who are helping is what hurts us all,—I honestly believe they total less than ten per cent. of all central station men.

High class engineers have for years worked to produce apparatus that will give great economies. This is more true in the electric field than any other class of engineering and they have accomplished something, but the greatest economy has been brought about not so much by change in design as by larger units and better load-factor. In the old days, electric stations operated from dusk in the afternoon until one a.m., or perhaps until daylight, with a load-factor of 5 to 6 per cent. A little later we ran our plants twenty-four hours a day, and with a combined railroad and lighting plant we had a load-factor of perhaps 25 per cent. and sold current at 20 cents a kw.h. Now the universal power in small establishments is the electric motor. Domestic appliances are everywhere. Our generating units have gone from 37½ and 50 kw. to 15,000 or 20,000 kw. and now we are soon to see one of 30,000 kw. installed in the city of Chicago. Load-factor is being improved constantly. We are all looking for the ideal 100 per cent. and our chances are good,—but how? Most of our power motors are cutting out about five or six p.m. and starting at seven or eight a.m. Our regular residence and commercial load is off the lines by midnight (except in New York); but we cannot turn night into day everywhere and we cannot expect to see the time when all factories will work nights as well as days, for men will not do it. What we must get is a load from ten, eleven and twelve o'clock at night until seven in the morning, and the electric vehicle is the one thing to do it and give the load necessary to flatten out the load curve.

The electric vehicle salesman has convinced thousands of ladies that the electric pleasure car is what they want—the central station man did not do it—and thousands of these vehicles are in use today and are here to stay. The electric truck salesman has convinced hundreds of up-to-date merchants and manufacturing companies. The result is that thousands of electric trucks are in daily use and they work every workday. These salesmen have increased the revenue of electric light and power companies thousands of dollars annually. Now what co-operation and help do we get from the average central station man I say, emphatically, not a particle. We thank our lucky stars there are some exceptions and the exceptions are the ones that are now getting the greatest return for their help and assistance given when we needed it most.

In the city of Chicago there were in use:
November, 1910, 80 electric commercial trucks.
November, 1911, 150 electric commercial trucks.
April, 1912, 263 electric commercial trucks.
November, 1912, 365 electric commercial trucks.
January, 1913, 523 electric commercial trucks.
May, 1913, 647 electric commercial trucks.

And, as the saying is, "that's going some," and the live combinations in this city are hoping for a thousand by December 31, 1913. While some of us are working for trucks all the time, some others are just as hard at work on pleasure cars. While the pleasure car is exceedingly popular with the ladies, the business man is putting it to a broader use to meet his requirements around the city, for the electric is the only real practical car for city use.

Some ten years ago, I was the owner of a couple of electric cars, a runabout and a surrey, and being a central station man, supposed I should know all about them because they were electric. I had a lot to learn and it was expensive. Current for charging cost 15 cents per kw.h. at first, and later 12 cents, and today, in most places, you pay 10 cents, if you keep your car at home. But in Chicago, in public garages, you pay from 2 to 6 cents, depending on quantity.

Chicago electric interests have been in favor of electric vehicles for years and are using them to the exclusion of other types of vehicles. Boston has always been a strong advocate. Philadelphia and St. Louis have pushed the electric vehicle constantly, and recently the New York Edison Company has come very strongly to the front in pushing the electric vehicle, and today in New York City we have nearly 3,000 electric trucks.

The big express companies, the American, Adams, Wells Fargo and others, after a try-out of gasoline versus electric cars, go in strongly for the electric car for city service, and it is no experiment with the express companies. Extensive investigation and careful checking of results, were what determined the final decision. In five years there will be thousands of electric trucks in this one service. Now, tell me, why should the electric light and power man hesitate as he is doing at this time?

Some of the largest fleets are in the brewery interests, one brewery in New York having 112 electric trucks of large capacity—all of one manufacture, and the breweries have not gone into this in a wholesale way without a try-out. They have taken years to test it out. The result is that a representative of one of the largest breweries in New York made a public statement at the Brewers' Congress in Boston, Mass., October, 1912, that the electric trucks were saving his company over $80,000 per annum in delivery service.

The electric light company in New York did not sell the brewery company that lot of trucks. It was a matter of indifference to them at the beginning, but not so now. Today the electric light company is on the job every minute, and employs some of the brightest brains and business talent in the country to push the sale and use of electric trucks and pleasure vehicles.

Now, if this is good business for New York, Chicago,

Boston, Philadelphia, St. Louis, and some of the larger cities, why is it not equally important to every one of you who manage or who are responsible for a generating plant and really interested in its success?

Wherever you find a Doherty company you will find every man on the job pushing electric vehicles and, what is best of all, this company is using them at every point. That organization practises what it preaches. I wish all of you were as consistent.

Hartford, Conn., has also become an agent for a prominent truck and is selling current by the can, as it were, on a flat mileage rate and apparently it is a big success.

We could go on and mention a number of others but that is not the point I am aiming at. What I want you all to realize is that I am directly after the manager, the "New Business Man," the chap who is actually responsible for the sale of current of every company in this great country of ours. I wonder if the managers of all operating companies realize that the new business man, the real business getter, is more responsible for reducing costs and increasing revenue than the engineer at the plant in 75 per cent. of the operating companies of today.

It is easy to figure what flatirons, cooking and heating appliances and many other things are going to do to help our load-factor. Motors for power, while long hour business, lap over and increase peak and in a great many cases increase investment charges, but current for charging electric vehicles is off-peak business.

Because I was in the operating end for over twenty years is the reason I am now reading this paper. I feel that I can see both sides of the question and I know that more than 60 per cent. of the men in charge of properties will not do the first thing to help push the electric vehicle. I know of one place where an express company installed some electric trucks but in a few months had to take them away and send them to some other city, because they could not get anyone in the city to take care of them properly, yet the electric light and power company in that city is supposed to be up to date in every way. I might add that this company uses gas cars for their own work.

Only last week one of our salesmen wrote from a good-sized city in Ohio as follows: "Mr. W., secretary and treasurer of this company, recently bought a gas truck. He said he had heard a lot about electric trucks but they had been afraid to install the same, thinking the electric railway, light and power company would have electrics if they were economical and reliable." Gentlemen, this is the example over again. Practise what you preach.

Some of our central station men say that the electric truck is too heavy and will not do their work, that it takes too much power to move itself; they do not stop to check up that 5-ton electric truck, with an up-to-date battery, will weigh less than a 5-ton standard make gas truck, but it is a fact. That same man will approve of an electric pleasure car that is so built and arranged that it is only carrying one pound of load for every eight to ten pounds of vehicle, while he will hesitate to use or advocate the lighter capacity electric trucks where we have one pound of load for every four pounds of vehicle; and on the 5-ton electric truck we just about balance a pound of load for a pound of complete vehicle, so when we come to real efficiency, we excel in the larger capacities. And 5-ton trucks will use current on an average, if worked to full capacity of load and mileage, 900 kw.h. per month or 10,800 kw.h. per annum, or in round figures $450.00 to $500.00 per annum current cost. Now, suppose you have one hundred 5-ton trucks in your city at $500 per annum, that means $50,000 added to off-peak business without a dollar of increase in investment, no more for labor or depreciation, only added cost of coal, water and oil. This, I believe, proves what I have said at the start. You are overlooking the one best and biggest thing that it is possible to get.

When the time arrives that it is impossible for a central station manager to see a wagon load of merchandise passing on the street without mentally translating the impression into terms of dollars and cents of revenue from off-peak load, then he will get busy on promoting electric vehicle activities. At the present time most of you are travelling in the rut of old methods and this business is going by you in streams every day without suggesting to you that it is and should be your business.

In 1910, the railways transported, exclusive of duplication, 1,026,491,782 tons.

It would be interesting to know just what percentage of the total tonnage was of necessity hauled to and from freight terminals, possibly 25 per cent. of it was trucked twice, perhaps four times, between the point of original shipment and ultimate destination.

Suppose you should translate these possible ton miles of truck hauling into terms of kw.h. and then into dollars of revenue. The amount would seem like a dream, but it is a possibility and it is slowly but surely coming. Now, let us all try to get some of that revenue while we are here, not leave all of it to the future generation.

The electric vehicle salesman or the manufacturing company he is working for cannot do it all. We have convinced the live merchant, the big express companies, the entire brewery industry, but the average Central station man is still to be shown the light of day.

Personal

Mr. K. L. Aitken, formerly general manager of the Toronto Hydro-electric System, has returned from Europe and will resume his practice as consulting engineer. Temporarily, letters may be addressed in care of the Toronto Hydro-electric System, 226 Yonge street, Toronto.

Mr. E. A. Ablett, manager of the Siemens Company of Canada, Limited, Montreal, is on his way to the Pacific Coast, for the purpose of visiting the electric winder installation at the Canadian Collieries, Vancouver, and also inspecting other plants in the west supplied by the Siemens Company. He will be away about seven weeks.

Mr. A. T. Goward, Victoria manager of the B. C. Electric Railway Company, accompanied by Mrs. Goward, recently left on an extended visit to England, where they will spend several months. While in London Mr. Goward will discuss with the directors matters pertaining to the company's undertakings in Victoria and immediate vicinity.

Mr. H. W. Curling has recently arrived in Canada to assume the position of managing director of the Canadian Union Electric Company. Mr. Curling comes but recently from South Africa, where for over three years he has been directing the operations of the Union Electric Company of London. During that period the many installations he supervised for them included the complete equipment of the plant and power lines for the Roodepoort Marisburg municipality; also the heating, lighting and power installation for the Rand Daily Mails.

Mr. W. G. Chace, of the firm of Smith, Kerry & Chace, who was construction engineer for the city of Winnipeg in the building of the municipal power plant, spent a week in that city lately on general business. Since leaving Winnipeg over a year ago, Mr. Chace has had charge of several large electrical and power installations for his firm in the United States. Last winter he was at Boise, Idaho, where he installed a big power plant for the pumping of water for an irrigation scheme.

High Voltage Transmission Systems*

A Review of their Electrical and Mechanical Design with Special Reference to the Equipment of the Shawinigan Water and Power Company

By Mr. Julian C. Smith

The subject of this paper is the design of a high voltage transmission line supported on steel towers. It will be considered in three sections, electrical design, mechanical design and the legal or public aspect of the problem.

ELECTRICAL DESIGN

The first point to be determined is the voltage required at the receiver end of the line in order to deliver the required amount of power with suitable regulation.

As the distances of transmission have been increased, the delivered voltage has been raised, till at present the use of 110,000 volts has become quite common and a few lines are either in operation or planned using considerably higher voltages than this.

In a new installation the delivered voltage may be determined with relation to the economic requirements or the state of the art.

The cost of all transformer equipment, switching apparatus, lightning arresters, etc., increases very rapidly with increased voltages above 100,000 volts. The transmission line must therefore be a very long one and the amount of power large to justify a delivered voltage in excess of 100,000 volts.

The frequency is also an important factor in the determination of the delivered voltage. The regulation of the line is a function of the frequency as well as of the current, and so it is not necessary to use so high a voltage for 25 cycles as for 60 cycles, if the regulation is the determining element.

In the opinion of the writer there does not seem to be any good reason for using any delivered voltage between 60,000 volts and 100,000 volts, unless there are existing conditions at the point of delivery, which have a bearing on this subject.

Having decided on the delivered voltage, the voltage required at the generating station can be determined by combining the impedence drop in the line with the delivered voltage. The generator voltage is usually higher that the delivered voltage, but with long lines and high voltages at no load, the charging current of the line may cause the delivered voltage to rise considerably above the generator voltage. For example, on the line between Shawinigan Falls and Montreal, the voltage at no load is 2 per cent. higher in Montreal than at Shawinigan Falls.

The methods of computing the regulation of transmission lines will not be treated here. The simple method, in which the capacity of the line is considered to be concentrated at the centre, is satisfactory for lines up to 75 miles in length with voltages up to 100,000 volts at 60 cycles. For longer lines using higher voltages it is necessary to take account of the fact that the capacity is distributed over the whole length of the line and that the charging current varies from a maximum at the generator end of the line to zero at the receiver end.

The calculations involving the use of hyperbolic functions are comparatively simple and give the exact result with about the same amount of computation as in the simplified methods.

[Attention was here drawn by the author to a regulation diagram, showing the voltage required at the power station under different conditions of load and power factor. This diagram, which was based on the well-known Mershon diagram, exhibited clearly the very great effect that the power factor of the delivered load had upon the regulation of the system, and therefore upon the voltage required at the power station. It was also shown by diagram, that at no load a delivered voltage of 81,000 volts requires at the power station a voltage of 78,000 volts. Assuming then a load of 10,000 kw. delivered at 81,000 volts, the voltage required at the power house with unity power factor of load would be 85,000 volts, a difference of 4.94 per cent. of delivered voltage. At 90 per cent. power factor the voltage drop would be 15.3 per cent., at 80 per cent. power factor 21.6 per cent. and at 75 per cent. power factor 24 per cent. (including transformer drop). These calculations were based upon a frequency of 60 cycles. If 25 cycles were used, conditions would be very materially improved as regards regulation, and therefore the power could be transmitted over a greater distance or a better regulation could be obtained].

At the present time in the United States and Canada, there are only two standard frequencies, 25 cycles and 60 cycles. When discussing the choice of frequency, it is important to bear in mind the effect the power factor has on the regulation. A frequency of 60 cycles is preferable for most cases, but if the power factor is low the lower frequency becomes of more importance.

In the question of choice of frequency, a number of points in design are involved, among them being the relative cost of 25 cycle and 60 cycle generators and transformers, and the relative performance of 25 cycle and 60 cycle apparatus.

In general, for the same capacity, the 25 cycle apparatus weighs 25 to 50 per cent. more and the cost is proportionately higher.

From the operating standpoint, 25 cycle induction motors are generally conceded to be somewhat superior to 60 cycle motors, as they are more efficient and give better power factor. It is easier to obtain low speeds with 25 cycle apparatus than with 60 cycle, as it is impossible to get more than a certain number of poles in a given circumference. Therefore, for a given diameter the speed of a machine is considerably higher with 60 cycle current than with 25 cycle current.

For railway purposes and the supply of rotary converters, the use of 25 cycles has certain advantages.

Sixty cycle rotaries cannot be built in as large sizes as the 25 cycle machines. The largest 60 cycle rotary which can be built is perhaps about 2,500 kw., while 25 cycle rotaries can be built in units of twice this size.

A 25 cycle rotary is more efficient and has better operating characteristics than a 60 cycle machine and is not so likely to flash over.

For ordinary street railway service, however, there is so much discussion at the present time as to whether rotary converters are preferable to motor generator sets, that a full discussion of this matter would be a paper in itself.

The question of frequency, however, is involved with the question of charging current on the transmission line. This charging current, as mentioned above, is a function of the voltage, the frequency, and of the capacity of the transmission line. At 60 cycles therefore the charging current

* Presented before the Can. Soc. C. E.

at the power station is two and four-tenths times as much as at 25 cycles.

A few years ago the charging current was thought to be a source of trouble and danger in the design of a power system. With small units used for the generation of power and long lines for the transmission, it is possible to obtain such a large charging current that the generators in the power station are overloaded. For example on the transmission line from Shawinigan Falls to Montreal, the charging current at normal voltage is about 25 amperes and this is equivalent to about 4,000 kv.a., one-quarter the capacity of one unit.

If the system can be designed completely, including the design of the power station, with a knowledge of the load, the charging current of the transmission line may be utilized as an advantage rather than the opposite.

On examining the curves of the voltage and the current on the line from Shawinigan Falls it will be noted that the current at no load, that is, the charging current, varies from zero at the Montreal end to about 25 amperes at the Shawinigan end. It will also be noted that the power current, that is, the current in the wires, when full load is being delivered in Montreal, varies from 99.5 amperes at the Montreal end to 88 amperes at the Shawinigan end. This decrease in the current is due to the fact that the charging current is out of phase and in advance of the power current, and therefore compensates to some extent the lagging component of the power current. On account of this condition, the power factor at Shawinigan Falls on the high tension side of the transmission line is 8.7 per cent. higher than on the high tension side in Montreal.

From the charts which have already been shown, it is evident that the power factor of the load has a very important effect on the design of the transmission line. The charging current of the transmission line helps matters out by improving the power factor on the generators to some extent. To counterbalance the charging current of the line, there is the magnetizing current of the transformers. If these transformers are designed for large reactance, and are made with silicon steel, the magnetizing current will be between 3 and 10 per cent. of the full load current. For practical purposes the full amount of this magnetizing current of both step up and step down transformers may be considered as opposing the charging current.

As the charging current varies with the voltage and length of the line, and the magnetizing current varies as the size of the transformers and inversely as the voltage, each case must be worked out separately. Only a general statement can be made that usually the magnetizing current does not make a very considerable difference.

The efficiency of transmission is the ratio between the amount of energy delivered to the amount of energy generated. We can deal with the all day efficiency so called, or with the efficiency under maximum load conditions. The all day efficiency is important in considering the effect of coal burned in a steam plant, or in considering the amount of water stored in a water power plant in which there is a certain amount of storage of water at the power development. Both of these efficiencies have an important bearing on the cost and the size of the machinery and transmission line. The efficiency of the line itself depends principally upon the size of the conductor. So long as the voltage is kept below what is now termed critical voltage, there is no corona loss, and the only loss of energy in the transmission line is that due to the heat generated in the conductor, and possibly a certain amount of energy used up in the insulation surrounding the line.

Unfortunately the designing of transmission lines to-day cannot be based altogether upon economic grounds as regards the best efficiencies. The size of the conductor is determined to a considerable extent by other considerations than the amount of energy loss.

For example, the writer would refer to curves, which are shown later in this discussion, representing the enormous losses with certain sizes of wires at the higher voltage.

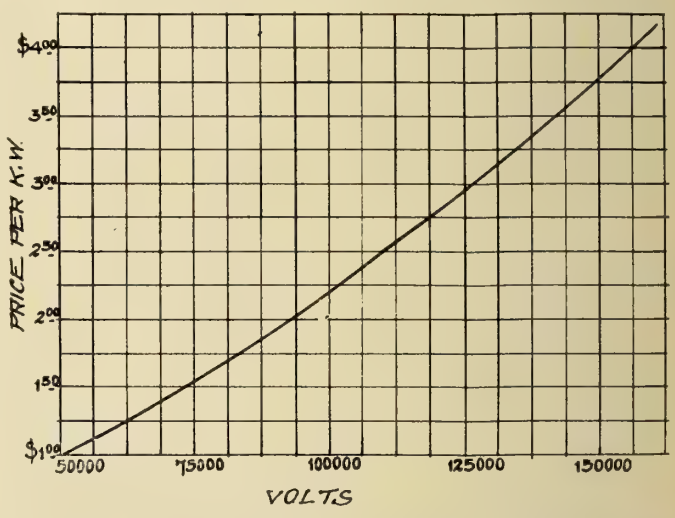
It is evident that if one desired to transmit power at 200,000 volts, it would be necessary to use a conductor of a diameter of two centimeters, equal to 500,000 c.m., or to space the wires more than 10 ft. apart. These figures are based entirely upon the corona loss and not at all upon what might be desirable from the point of view of the amount of energy to be transmitted.

Also very few power plants today can afford to neglect the all day efficiency. This all day efficiency depends very much upon the shape of the load curve. If the load transmitted is subject to wide variations, and has a high peak, it is evident that it is better to suffer a considerable loss for a short time each day rather than put in a large investment to keep this loss down.

These statements regarding efficiency at full load and all day efficiency are of course elementary parts of the well-known Kelvin's law.

It is desirable to call attention, however, to the fact that in the design of these tower lines the cost of the conductor, while it is a large item in money, is not such a very large percentage of the total, and particularly when the cost of right-of-way is included in the total cost of the line.

Of all the parts of the line, however, on which there may



Approximate cost per kw. of transformers for various voltages

be a saving, the only one which can be changed and still keep the design safe is the size of the conductor, and this within comparatively small limits.

It is very difficult to apply Kelvin's law to any transmission project, for two reasons.

1st.—The ultimate cost of the transmission line cannot be determined accurately on account of the largely unknown cost of the right-of-way.

2nd.—The amount of power to be transmitted is in most cases not accurately known.

Thus the tendency is to keep the cost of the conductor within reasonable limits, and permit the size of the conductor to be determined to a large extent by other factors than in Kelvin's law.

The argument has been advanced that the cost per horse-power of a transmission line can be maintained a constant quantity by increasing the amount of power transmitted at the same ratio as the cost of the line. Thus for example if a line cost $100 per horse-power to transmit 10,000 h.p. for 100 miles, this cost could be maintiained for 200 miles by

transmitting three times as much power if the 200 mile transmission line cost three times as much as the 100.

One must admit the force of this argument if there were no limit to the amount of power which could be transmitted. Grounds of policy and safety demand, however, that there be a limit put on the amount of energy transmitted over a single line. The writer has felt that this limit in this neighborhood, and under conditions existing in Canada, is not more than 25,000 kilowatts per tower line.

As further experience is gained in the reliability of operation of steel tower lines, it is possible that this amount may be increased, but there will always be a certain element of risk involved in the transmission of power by overhead means, due to malicious interference or to the necessity of shutting the system down on account of the interference of other constructions which may necessitate such an interruption of service.

Closely connected with the question of efficiency is the regulation. The writer believes that for lines that are designed to transmit large amounts of energy from one point to another, that the permissible regulation is approximately twenty-five per cent.

If a high tension network is designed which distributes energy over a wide range of territory, it is essential that the voltage regulation on this high tension network be made as close as possible, and for that reason a high tension network necessarily costs very much more per horse-power than a line designed to deliver power from one point to another, such as the Shawinigan transmission line. Thus one cannot compare the Shawinigan line with a system such as the Hydro-electric system, and the regulation of the Shawinigan system of about 20 per cent. with the regulation of the Hydro-electric system of about 5 or 6 per cent. These figures include the regulation of the transformers.

Considerable discussion has arisen in the past over the subject of resonance. Some years ago this term covered a multitude of sins and no one had a very clear idea of the phenomena involved. To-day the art has advanced to such a point that what we call true resonant phenomena rarely exist.

Every transmission line has a certain natural frequency, and if electric waves are impressed on the line at the frequency of the line, these waves will traverse the line and be reflected from the ends and there may arise a condition of standing or travelling waves which will develop high potential points and do damage.

The natural frequencies, however, are quite above the ordinary range. For example, in an eighty-seven mile line such as the Shawinigan, the natural frequency is 550 cycles per second.

On some transmission systems the charging of the electrolytic lightning arresters has developed a very high frequency oscillation. This seems to be due to the fact that the lightning arrester is a condenser and the transmission line itself has a very large capacity.

When the lightning arrester is connected to the transmission line through the charging horns, an arc forms which charges and discharges the capacity of the electrolytic arrester at a frequency which depends upon the constants of the line and of the arresters, but this frequency is very high, something of the order of 1,000 cycles per second, and these high frequency waves of small magnitude travel considerable distances over the line, and wherever reactances occur, such as end turns of transformers, series transformers or choke coils of any sort, a high voltage is developed by reason of the passing of the high frequency current through the reactance.

Thus it seems evident that if the electrolytic lightning arresters are to be used for the protection of transmission lines, some method of charging these arresters will have to be developed, which will eliminate the disturbances above referred to.

In designing any transmission line, the voltage of operation must be kept below the critical voltage.

[The author here quotes an approved formula for determining the critical voltage and the power loss].

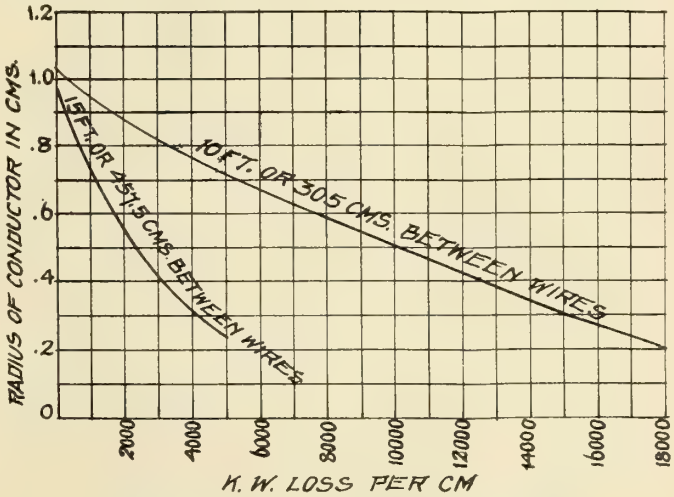
It is not desired to discuss the phenomena of corona loss except as bearing upon the design of a transmission line. It is interesting to note, however, that the corona loss varies considerably with weather conditions, and that snow particularly lowers the critical voltage and makes the line more subject to breakdown.

The critical voltage depends upon the diameter of the wire, and to a lesser degree upon the distance between the wires, so that the corona loss can be reduced by either using larger wires or spacing them at greater distances.

This formation of corona and the resulting loss offer an explanation of a number of operating difficulties which have developed in the past few years.

Considerable trouble has been experienced with all high tension fuse wires, and even fuses on potential transformers on voltages as low as 12,000 volts have given trouble. This seems to be due to the formation of corona on these very fine wires which affects the material composing the wire and ultimately causes the destruction of the fuse.

Before closing the discussion of the electrical design of the line, the writer would mention briefly the status of lightning phenomena and lightning protection as it appears to him at the present time.



Corona losses for 65 mile, 200,000 volt line

Lightning phenomena are considered to be due to current rushes passing from an area of high potential to one of low potential, the discharge being of an oscillatory nature. The frequency of this discharge is of the order of 100,000 cycles per second or greater, and the magnitude of these current rushes may be as great as 10,000 amperes. The duration is exceedingly short, and the wave front exceedingly steep.

The disturbance occurring in the neighborhood of transmission lines induces in the line itself a high frequency oscillation which, travelling throughout the whole or a part of the line, forms points of high potential, or if the wave is of the proper length, the points of high potential may occur at the ends of the line where the transformers act as reflecting points.

(To be continued)

The gross earnings of the Toronto Railway Company for the year ending August 31st, 1913, were $5,880,548, as compared with $5,176,170 a year ago. The city's percentage amounted to $1,007,082, as compared with $863,563 in 1912.

Financial Needs of the Electrical Industry

A Review and Analysis of Future Capital Requirements of the Electrical Industry by Mr. Frank A. Vanderlip, President National City Bank, New York before the Society for Electrical Development

Four hundred million dollars a year, $8,000,000 a week, of fresh capital can profitably be used in the development of the electrical industry in the United States during the next five years. What the calls for new capital might reasonably be expected to reach after five years no one can predict with accuracy, but I believe it is a conservative estimate to say that the intelligent development of the industry as a whole will readily absorb $400,000,000 per annum for the next five years, if that amount is available.

In making such an estimate, one does not need to draw on one's imagination. There is no need to picture broadening fields of application, new methods of production and distribution, nor new uses for energy. A survey of what has been going on about us comes near enough to being a fairy tale. Little more is needed than a grasp of present-day statistics, compared with those of five or ten years ago, to give the basis for such an estimate.

We have seen the cost of construction and equipment of all central stations increase in the five years from 1902 to 1907 from $500,000,000 to well over $1,000,000,000, making an increase of 117 per cent. in that five-year period. We have seen the output in that time go from 2,500,000,000 to nearly 6,000,000,000 kw.hr., making an increase of more than 133 per cent. The five years from 1902 to 1907 is the last period for which we have complete statistics for the whole country. The government is now collecting the figures for the five-year period ending with last year. In doing that schedules have been sent to 7,000 stations and power plants, compared with 4,750 in 1907—and it has been estimated that the cost of construction and equipment of central electrical stations will show an aggregate in 1912 of $2,000,000,000, as against $1,096,000,000 five years ago. Here, then has been a requirement in five years for central station work alone of $900,000,000, or, roundly, $180,000,000 a year, as against a similar requirement in the preceding five-year period of $100,000,000 a year of new capital.

When we think what is certain to be done in the way of electrification of steam railroad terminals and heavy mountain grades, when we reflect on the larger use of electrical energy for industrial power, in agricultural uses, and in the continued growth of necessary interurban lines, we do not need to look further into the possible development of the industry to see a requirement for $400,000,000 a year of new capital.

That means an $8,000,000 new capital issue every week for the next five years. It is such a capital requirement that you gentlemen are facing, and which must be successfully met if your energies are to have an adequate field of display. Can you get it?

Capital Needs in All Fields

It seems to me that there is no more interesting question that can be proposed to those interested in the electrical industry. When the matter is put so concretely as a new $8,000,000 capital issue every week for five years, the size of your financial problem can be readily grasped. To get a full appreciation of the difficulties, you may well glance outside of your own field, however, and note that there will mature within that five-year period well over $1,000,000,000 of steam railroad securities. We may well note, too, that railroad development in the last five years called for from $2,500,000,000 to $3,000,000,000 of new capital, and I would say that there is every reason to expect at least as great demands, in addition to the refunding operations in the next five years. The railroads, then, in five years will need, say, $4,000,000,000 for refunding and fresh capital. States and municipalities, should they take no more new capital in the next five years than they have in the last five, will absorb in the neighborhood of $1,500,000,000 more, so with the $2,000,000,000 your industry will need, there should be provided between now and the end of 1918 between $7,000,000,000 and $8,000,000,000 for these three purposes alone, to say nothing of general industrial and other needs.

These are bewildering figures. They sound more like astronomical mathematics than totals of round, hard-earned dollars. The raising of these sums, however, is the practical problem that financiers have directly before them.

Financiers must count on two elements over which they have no control if they are successfully to accomplish the gigantic task. One factor is the size of the possible investment fund itself—the question whether or not there can be made available a total amount of capital for fresh investment that will meet the demand which can be clearly foreseen in these three directions alone—that of general transportation, the production and application of electrical energy, and municipal capital expenditures.

The second factor is whether or not the outlook in these fields of investment is such that the elements of adequate return and ultimate safety will satisfy the owners of capital and lead them to direct such a vast stream of new investment into these fields.

At this time I will not attempt to go into the first factor—the size of the possible investment fund. That would require a world-wide survey of the growth and wealth and an examination of the effect of modern legislative tendencies; it would need an examination of the drain which the vastly increased rate of taxation here and abroad is putting upon capital; of the terrific wastes of militarism, that cancer which is eating into the financial life of Europe at such an alarming pace, and of the other phases of government expenditure, national, state and municipal, which are absorbing such vast totals of capital into public and largely non-productive uses. It would necessitate taking note of the tendency toward individual extravagance, a tendency that is world-wide and which is cutting into the investment fund to a startling degree.

The Electrical Outlook

Passing entirely this important side of the subject, making no examination as to whether or not the investment fund can possibly be large enough to meet the demands that can be clearly foreseen, let us take up only the narrow question of whether or not the outlook in the filed of electrical industry is such that there is promise of adequate return and ultimate safety sufficient to warrant an expectation that $400,000,000 a year of fresh capital will flow into the electrical public utility field.

In spite of the vast proportions that the electrical industry has already reached, the huge total of capital investment which it represents, the substantial standardization of the business, the complete social and industrial necessity which your work has created and met, electrical securities are still regarded by the general investor, the capitalist, as occupying

a new and only moderately seasoned and tried field for investment.

The Investor in Electrical Securities

Among ten average investors in corporated securities, perhaps not over one, certainly not over two, have as yet invested at all in electrical securities. I think it is conservative to say that among individual investors certainly not over 20 per cent. in numbers have yet recignized that securities issued by electrical corporations have come within a range which will permit investors conservatively to employ their funds in that field. It is not easy for you, perhaps, to realize how very recently it is that the whole field of your business has reached a point where an investor might fairly feel that he was not entering a field of experimentation, that the art was sufficiently advanced and standardized to make it reasonably sure that some brilliant inventor would not upset all financial calculations, that the most up-to-date establishment might not be turned into scrap by advances made in the science long before the investor had made important inroads on the coupon sheet of his bond. As that feeling of insecurity passed and the business became more nearly standardized, there then came to be emphasized difficulties in regard to franchises, until the very phrase "public service corporation" carried with it to the investor's mind unpleasant pictures of difficulties with boards of aldermen, of threatened charters, expiring franchise rights, new forms of taxation, state-fixed rates, and profit divisions with municipalities before undreamed of.

Investors Fear Politics

Four out of five investors at the present time have their minds closed against any investment in securities of electrical corporations, and that is true largely because they fear the effect of present political conditions and tendencies. An investor who has such a fear may not be marching in step to the so-called new freedom; perhaps he does not recognize fully the force of the principles advocated in our new progressive politics. But remember he still controls his own capital; remember that it is his individual decision that determines in what field that capital will be invested. The problem that the banker has to face is to convince investors holding such views that capital issues of this type are attractive, and when you ask bankers to convince enough investors of this so that they will absorb $8,000,000 a week of new capital issues, you are outlining a large task.

The time has now come, in my opinion, when no man with capital to invest in corporate securities, if he has a desire for return that is any larger than government obligations will pay, can longer hold back from the study of public utility investments. The experimental inventive stage is past. The business has a background that has now become broad enough so that one can make valuable comparisons and sound deductions. It has ceased to be a business of only small units, and the tendency is markedly in the direction of great capital issues which shall have at all times a broad market. The dangers from a prejudiced, unwise or unfair vote by a municipality or a board of aldermen are being greatly lessened by the newly organized public service commissions, and these same bodies, recognizing the monopoly character of the business, are guarding it from useless and venal competition, as they are also guarding the investor from too free capital issues by the optimistic developer or the enthusiastic promoter.

We are a long way from having either uniform or satisfactory administration of public service commissions, it is true. This word commission has a sound of wisdom, experience and justice about it, but after all commissions are but composed of men, and sometimes of very poorly equipped even if honestly intentioned men. All this takes us into the question of government itself; but I think no one will deny that the securities of public service corporations are sounder and their future more secure, on the whole, because of the tendency to place the affairs of these corporations under the control of public service commissions.

Meet Proper Public Demands

If I may be permitted to say so, I believe the highest duty that you men who are managing great public service corporations owe to the business in which you are engaged, the greatest service which you can perform for the future development of this field, lies in the clear recognition by you of the true public service character of this business and in meeting honestly, intelligently and freely the proper demands that the public makes upon you.

Your dream is of great central stations that will supply energy to vast communities, and from which will radiate trunk lines that will become as necessary in the lives of communities as are lines of transportation, that will produce electricity which will become almost as essential to our every-day life as the blood in our arteries. That dream is fast becoming a reality, and it is right and proper that the public should hold over those who create such a situation a wise and just control. In the degree in which you recognize and meet this right of the public will you get fair treatment in return.

The public is by no means all-wise, when it is not well informed, nor is it always just. You can cite many instances, in your own field, of injustice and of unwise forms and methods of control, but I believe you will find back of every injustice which you have received at the hands of the public some measure of injustice, or unfairness, or lack of sincerity and frankness, on your own part in dealing with the public.

This business you are in requires qualities of statesmanship as well as inventive faculties, technical skill and business acumen. It requires clean-cut recognition on your part that you are creating a condition of affairs wherein the business in which you are engaged becomes of vital necessity in the life of the community, and you cannot and ought not to expect the community to fail to safeguard itself.

The measure in which you recognize the justice of the public's rights, the activity and skill with which you educate the public so that it can make wise decisions, the extent to which you refrain from unfairness or rapacity, and thus give ground for greater unfairness and rapacity in the public's dealings with you, will, to a large extent, be the measure by which capital will come to recognize the security which this form of investment offers.

Hold to High Standards

Those of you who keep in mind most clearly that any deviation from the highest standards on your part in dealing with the public is apt to lead to unfair retaliation and unjust regulation by the public of the business in which you are engaged will find that you are creating about your properties an atmosphere which will encourage the investment of fresh capital. Nor will it be enough for you to be fair and just. You must be both patient and energetic in educating the public, in giving them information which will permit them to form wise conclusions, to make sound laws and to recognize the tremendous importance of both high character and broad intelligence in the men who are appointed to positions on public service commissions.

The field is new. The unavoidable mistakes even at the hands of wise men will be many. In the end those mistakes will react on the development of the community itself, and if the voters can be brought intelligently to recognize this, there will be a strong force of public opinion to compel the appointment of properly qualified men to these positions of far-reaching influence.

Not only must you throw all the force you can in the

direction of securing properly qualified men on the commissions, but you must more broadly inform the public, so that the commissions will have back of them wise laws, framed by men who intelligently comprehend the new and intricate problems which your development of the industry has raised.

Today one of the greatest difficulties that the financial world encounters with public service commissions is on the ground of delay. Sometimes commissions fail to recognize the necessity for prompt action. Frequently they are so burdened and overladen with matters requiring their judgment that it takes months, or even runs into years, before decisions are rendered. Those charged with the duty of financing public service corporations have perhaps more ground for just complaint over commission delays than against the character of decisions after they are made. The commissioners themselves are by no means to blame for these delays. Not infrequently an impossible task is given to them to perform. I believe if the public understood this it would not be difficult to obtain laws which would permit the appointment of extra commissioners, or assistant commissioners, or in some manner to subdivide the work so that public business might be promptly cared for.

If, on the whole, the industry can look forward to fair and intelligent treatment at the hands of voters, municipal authorities and state commissions, it is reasonable from other points of view to anticipate that capital will be found to supply the needs for the development of the next five years, not to look further ahead than that. Nothing in connection with the business is more obvious than that the tendency is toward large units, large corporations and large issues of a single type of security. That all tends directly toward an absolute essential if we are to have a market for public utility securities as broad as the present market for railroad securities. There must be large issues, large enough to warrant the most careful investigation by issuing houses, large enough to make a market that investors can buy and sell in readily, and large enough so that there will be many minds centered on the operating facts back of that security, making the market price of that security represent the combined judgment of many investors, rather than merely the price placed on the security by an issuing house.

The investor wants large issues, but not at the price of over-capitalization. There has been much progress in the last few years in the direction of large issues, which has been brought about through the formation of holding companies that control a number of individual plants. In the creation of these holding companies there has frequently been a tendency toward over-capitalization, toward the building of one corporation on the junior securities of another, and even on the consolidation of holding companies and the creation of another type of security still further away from a primary lien. That tendency should be halted. There is quite enough imagination inherent in the business itself, without letting the imagination of the promoter come into play in creating issues with remote liens.

Principles for Holding Companies

The holding company theory, I believe, is admirable. It scatters the risk; it affords intelligent supervision and engineering; it makes possible cheaper purchasing of supplies; it gives a broader market and a lower cost of capital—but the relation of total capital to total income involves principles that a holding company can no more transgress with impunity than can the original corporation.

If the investor turns from these large considerations, involving the relation of the properties to public opinion and civic control, and the relation of capitalization to reproductive property values and to earnings, and looks at the technical side of the business in the present state of the development of the science, at the outlook for broader uses for more economical production, and at the growing necessity of society for the product which you furnish, then indeed there will be seen ground for the most optimistic view.

As I look back on my boyhood days I think perhaps the keenest hours of pleasure that I can remember were when I was deep in Jules Verne's "Twenty Thousand Leagues Under the Sea" or "The Mysterious Island." I have recently had a pleasure almost akin to that in reading from government reports some statistical abstracts setting forth the course of electrical development, and in studying the report of the committee on progress of the National Electric Light Association. That report of the committee on progress comes as near being a true fairy tale as I know of in current literature. It makes me envious of you men who are engaged in a field that has in it such possibilities—such certainties, one may better say, for the report deals with accomplishments rather than expectations.

Imagination in the Electrical Industry

Diversity factors, off-peak loads, the concentration of central stations, the opening of new fields for the use of energy, and the more complete filling of old ones, makes reading that fires one's imagination. The making of two blades of grass grow where one grew before becomes commonplace by the side of your accomplishments in cheapening the production of electric energy either by water-power conservation or central-station consolidation. When you add to that the economies of diversified load and open up the fields that low-priced current and off-peak loads make possible, you have created a business situation where there is as much need and opportunity for sound imagination as has ever existed in business life—imagination, not mere dreaming, but imagination that means the correlation and new application of known facts. Sound imagination here has unlimited play, and you need it all through your organization and down to every subordinate who comes in any real contact with the problems of labor and the practical affairs of life. As great rivers have affected population or railroad trunk lines have defined development, so will these distributing lines, carrying cheap electricity, affect our future growth.

The nation owes the greatest credit to those among you who have seen this clearly and who are contributing in the largest measure toward a fuller realization of all the possibilities. The man who conceived a 40,000-h.p. generator is as much entitled to honors at the hands of our government as the men who built the steamship Imperator were entitled to be decorated by their government.

The Reduced Cost of Electric Living

You are selling one of the few commodities that have gone down in price, while the cost of nearly everything else that enters into our life has gone up. I note that in seven years in which the cost of living is calculated as having advanced 37 per cent. the average cost of electricity has gone down 17 per cent. You are in the one line of business where the theory of consolidation seems to be fully accepted by everyone who intelligently understands the factors. Elsewhere in business there is a tendency on the part of the public to break up large organizations, but in your field the monopolistic nature of the business is recognized and there is the strongest tendency toward consolidation, and you are demonstrating, in consolidation, the greatest economies.

I note that forty-nine central stations in Illinois have been closed up and that four are doing the work better. I read that 400 central stations in New York State might better give way to forty, or even to ten. I see it demonstrated that what was originally your main business, the furnishing of electric light, is now but incidental, and I am told that the economies of diversified load are so large that the great steam railroads will undoubtedly be able to buy

power from central stations having that diversified load-factor more cheaply than they can produce it from their own central stations, however large their requirements may become. The diversity of load-factor which permits the serving of the countless needs of a great community from a central station, and which leads to organization on such a scale that the highest intelligence can be afforded for every detail of supervision and engineering, is the direction in which we are obviously and rightly moving.

An independent municipal lighting plant is either an indictment of the intelligence of the community where it is located, an indication of its failure properly to supervise and control the corporation operating there, or a criticism of the severest character against the management of the private companies. The government might as well undertake the organization of transportation lines solely for service in connection with the post office to carry the mails as for a municipality to undertake economically to produce electricity solely for street lighting.

The interesting statistics of your business show far more rapid increase in gross earnings than is shown by the railroads of the country, great as that increase has been. What is still better, in the face of a rapidly decreasing price at which energy is sold, net earnings show a greater precentage of increase than gross, while the tendency with railroads is distinctly in the opposite direction.

Electricity in Industries

No phase of electrical statistics strike me as being more interesting than the growth of the use of electric power in our industries. In ten years the horse-power of electric motors in use increased from less than 500,000 to nearly 5,000,000, until today about a quarter of the primary power used in the industries of the United States is furnished by electric motors. The most casual study of that development indicates that as yet it is but getting well under way, and that there are as striking advances to be made in the next few years as have been made in the last half dozen.

The statistics of the last five-year period, on the average cost of installations per kilowatt capacity, bear impressive testimony to technical progress, showing as they do marked and steady decline in the cost of installation and the consequent cheapening of product. To a layman it would seem that no field offered more attractive possibilities on the technical side than further improvement in long-distance transmission which will still further broaden the field of operation of a central station and tend toward larger units and economical consolidations.

Today a quarter of the total industrial power utilized in the United States is electrical. I am told that competent authorities believe that fully 85 per cent. of the total industrial power can eventually be economically taken over by central electric power stations. This means an addition of more than 10,000,000 h.p. with the present volume of industry and an expenditure in central-station construction of $4,875,000,000 for the production of that amount of electricity.

Those of you who are close to and an intimate part of the astonishing development of the electrical business find these, and a hundred other interesting facts that might be stated, but the commonplaces of your every-day business. They are such sound and substantial facts that you perhaps marvel that four out of every five investors in corporate securities have never bought an obligation of a public utility corporation. You can see how it is possible soon to be furnishing 15,000,000 h.p. instead of 5,000,000 h.p. to the industries of the country. You can see how it is inevitable that great central stations will produce electricity so cheaply that all the energy that is required for wide communities will soon be coming from single central stations.

On the other hand, I can see that, with a little more time for investors to become convinced that a public-service corporation is not another name for a target against which to level unfair state and municipal enactments, we may have four out of five investors buying such securities, rather than refraining from doing so.

In the mind of the investor, the outlook for fair public treatment of public-service corporations is the most important single factor in directing investment of capital toward or away from the electrical field.

I firmly believe that this matter of fair public treatment lies largely in your own hands. If you will do so as well with that as you are doing with the technical side of the business, the $400,000,000 a year of fresh capital which you need will be forthcoming.

Winnipeg Developments

Owing to their rapidly increasing load which, at present, amounts to approximately 15,000 h.p., during the peak, the city of Winnipeg Light and Power Department have decided to proceed immediately with the extension of their system. This extension applies to every branch, from the generating station, transmission lines and sub-stations, to their distribution system and arc lighting circuits.

The present equipment at the generating station consists of five turbo-generator units of approximately 30,000 h.p. overload capacity with transformer equipment consisting of six single-phase, 2700 kw. transformers. Tenders have been called for and contracts awarded for additional equipment as follows: The Escher, Wyss Company, of Montreal and Zurich, Switzerland, are supplying three turbines with an ultimate capacity of 6,800 h.p. each, designed to operate at 138.5 r.p.m. with 45 feet of hydraulic head. These turbines are to be direct connected by horizontal shafts to generators supplied by the Canadian Westinghouse Company. The generators will have a normal rating of 5,000 kw. at 6,600 volts and 60 cycles. The necessary transformer capacity is being taken care of by the addition of one 9,000 kw., three-phase, 6,600 to 66,000 volt unit, supplied by the Canadian Westinghouse Company, which firm is also supplying the necessary switching and control apparatus.

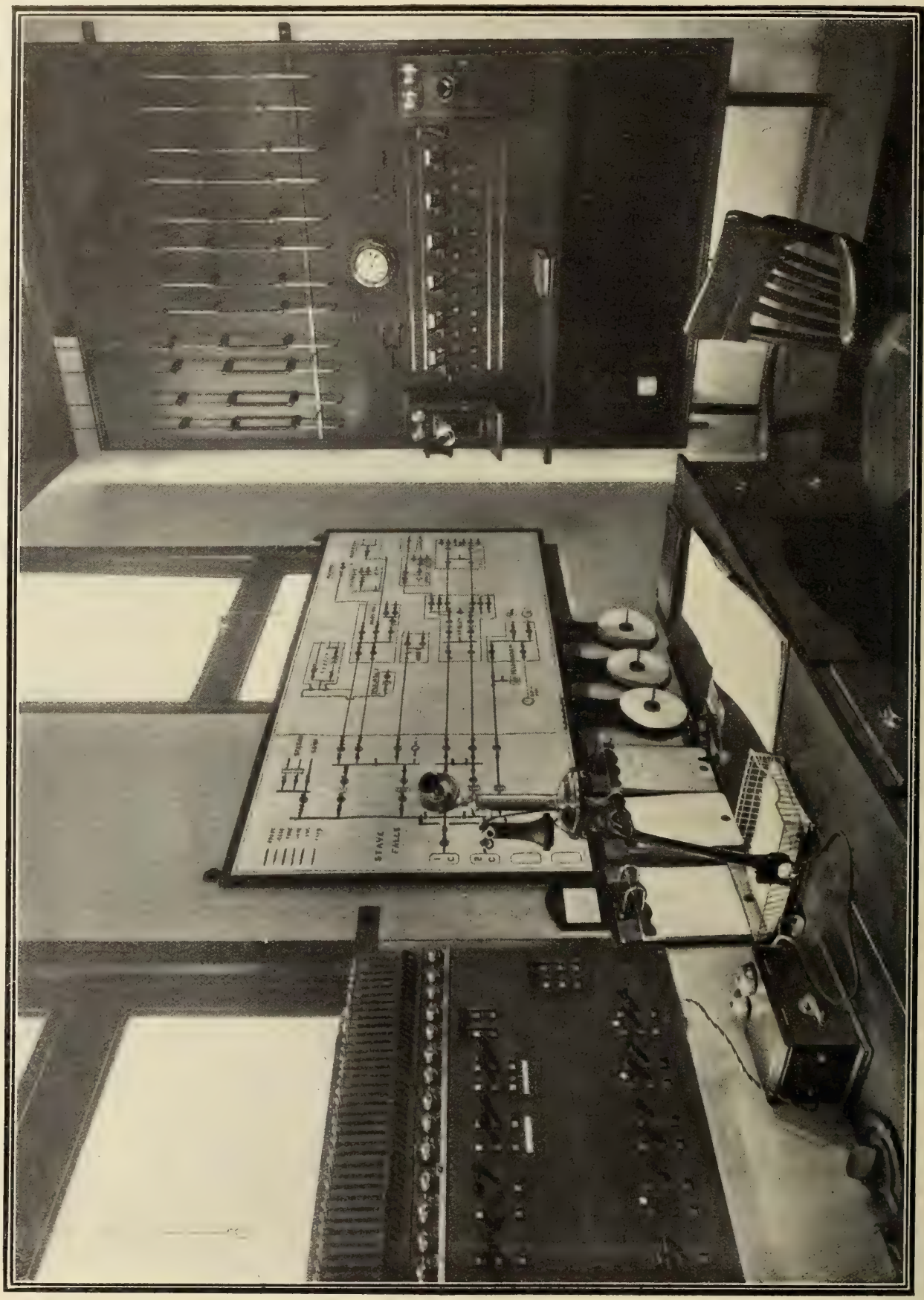
Tenders are now being called for by Mr. Peterson, secretary of the Board of Control, for the erection of a second transmission system on the present right of way of the city of Winnipeg, between Point du Bois and Winnipeg. This line will be designed to operate at 110,000 volts with suspension type insulators.

The extension to the terminal station will double it in size and capacity. The contract for the building construction has been awarded to the Fort Garry Construction Company and the Canadian General Electric Company are supplying new transformer equipment consisting of three 2700-kw. o.i.w.c., single-phase, 66,000 to 12,000 volt transformers.

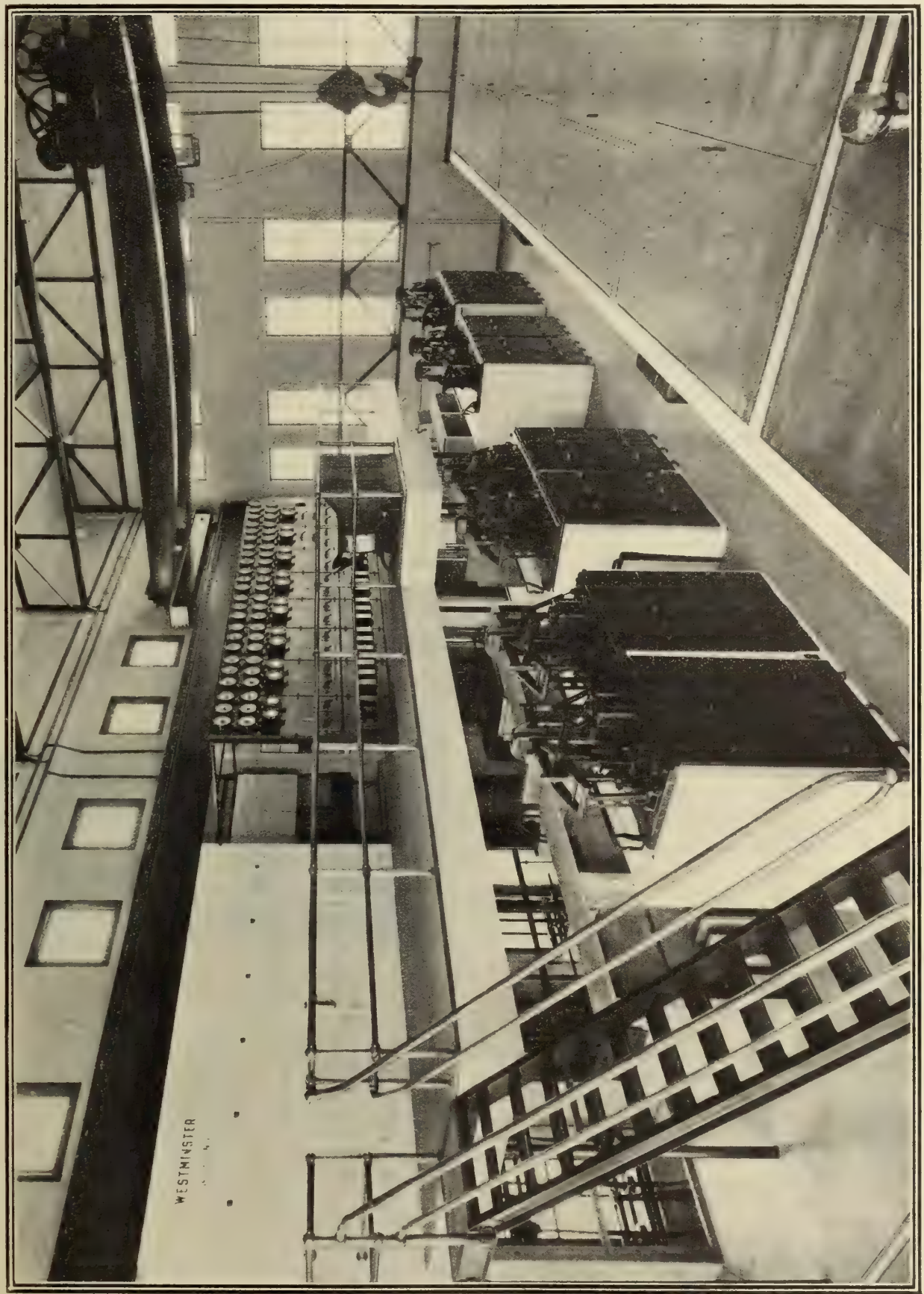
Sub-station No. 2 is being extended to accommodate three 500-kw. single-phase, 12,000-2,400 volt transformers which are being supplied by the Canadian Westinghouse Company. This will bring the capacity of this station up to 4,500 kw.

The new equipment at No. 1 sub-station consists of three 500-kw. single-phase, 12,000-2,400 volt transformers supplied by the Canadian Westinghouse Company, and also one 1,000-kw., 600 r.p.m., 550-275 volt motor-generator set, the contract for which has not as yet been awarded. This will bring the capacity of this station to 6,000 kw., including 2,000 kw. direct current.

The Imperial Wire & Cable Company, Montreal, received an order recently from the city of Winnipeg for 12,000 feet paper insulated lead covered underground cable.



View of Telephone Room in the Power House of the Western Canada Power Co.—Operating Chart in centre.



Western Canada Power Company.—A view of the interior of Ardley receiving station.

Telephone Selector Despatching System

A brief description of the General Railway Signal Company's train despatcher's telephone selector system, which is giving efficient service under exacting conditions, on several heavy circuits

The advantages of motor generator operation, especially in the cases of large, heavy circuits, have been demonstrated in numerous installations throughout the country but this company have further developed this idea by providing an arrangement whereby the turning of a calling key, to send a call, automatically starts the motor generator, which operates and supplies current for the call. When the call is completed the motor circuit is automatically opened and the motor generator stops.

The motor generator is operated from a 12 volt storage battery, which is charged, as required, from local commercial current or from a separate motor generator charging set. The motor generator is mounted on a switchboard from which the various local circuits are controlled. The switchboard not only facilitates the maintenance of the circuit but, by means of the voltmeter and ammeter, gives information as to line conditions. The voltage delivered by the motor generator is regulated by a rheostat and may be increased or decreased as line conditions require.

There are many small selector circuits, requiring low voltage, where the cost of full power equipment would not be justified and dry battery operation for these circuits is recommended. The selector requires a small number of impulses in a call and as each impulse requires less current than the usual selector the aggregate saving is considerable, which prolongs the life of the battery.

Electrically operated selective mechanisms are usually complicated and delicate but the designer of the G. R. S. selector has succeeded in eliminating many of the usual complications without sacrificing any of the essential features. This selector has no time element device and no preliminary or clearing impulses are used in its operation. The company have been very liberal in making allowance for future development in the number of selectors on a circuit as the system provides for a maximum of 324 call stations, or, in other words, each selector may be adjusted to respond to one, two, three, four, five or six of 324 combinations. A circuit having 324 selectors would require a maximum of 36 impulses in a call; circuits having 100, 64, 49, 36 and 25 selectors would require a maximum of 20, 16, 14, 12 and 10 impulses respectively. The selectors are usually equipped with contacts to close two bell or indicator circuits but six or less contacts can be furnished.

Standard time is transmitted to the local stations by means of the selector equipment on several installations and a similar arrangement provides for calling all stations simultaneously. Provision has also been made for the connection of two or more adjoining selector circuits.

When existing contracts have been executed, 9 selector circuits will have been installed, aggregating 922 miles, 283 selectors and 291 bells. Five of these circuits are on the New York Central R. R., three on the Illinois Central R. R., and one on the Toronto, Hamilton and Buffalo R. R. Motor generator operation is used on all these installations with the exception of the T. H. & B circuit, where current is supplied by a battery of dry cells.

The Rochester division of the New York Central, Rochester to Niagara Falls, was one of the first circuits equipped with selector apparatus and was completed in April, 1912. This circuit comprises 76 miles, 36 selectors and 36 bells. During the year ending April, 1913, there was an average of 544 and a maximum of 959 calls per day. The current consumed was 475 kilowatt hours. In this circuit the motor generator is operated from a storage battery, which is on float charge from a 110 volts d.c. commercial circuit. It is stated that this circuit is soon to be enlarged to include another division, at which time the motor generator will be operated direct from the commercial circuit with the storage battery in series with the motor circuit which will materially reduce the current consumption. Standard time is transmitted by the selector equipment on this circuit.

A heavy circuit on the Adirondack division of the New York Central is about to be equipped with this apparatus. This circuit comprises 250 miles, 49 selectors and 56 bells. The line voltage required is 400, which is normally supplied by an a.c., d.c. motor generator, operated from a 3-phase, 110 volt, 60-cycle commercial circuit. The storage battery will be charged by an a.c., d.c. charging set. A d.c., d.c. line motor generator is to be provided as a reserve, in the event of a failure of the commercial circuit, and will be operated from the storage battery.

Another New York Central installation comprises two circuits, one having 78 miles and 32 selectors, the other 108 miles and 40 selectors. These circuits will be operated from the same power equipment. The line voltage required is 200, which will be supplied in the same manner as the Adirondack division circuit, described in the preceding paragraph.

Figure 3 shows the wiring diagram for a typical selector circuit. Each key in the key cabinet starts the motor gen-

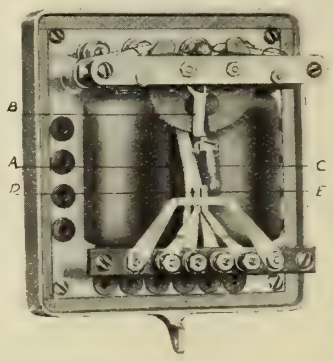


Fig. 2

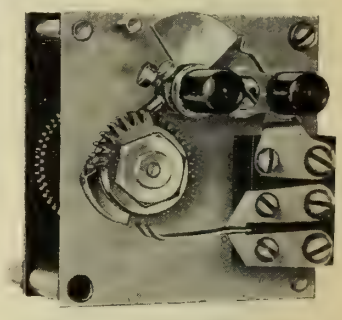


Fig. 1.

erator E by means of the motor control relay C; also each selector is connected to the line, as shown.

To call a station the dispatcher turns the designated key A5 one quarter turn to the right which closes contact 6 completing a circuit from the storage battery B through the motor control relay C which energizes the relay and its armature picks up, closing contact 7; current from the storage battery B now flows through the motor M of the motor generator E. The generator G builds up instantly and delivers such voltage as the line requires, being regulated by the rheostat D.

Returning to the key at A. The key stem of key A5 and the shaft on which the contact discs 2-3-4 revolve are so connected by the gear wheels, pinions and pawls of a simple clock-work mechanism that the movement of key A5 to the right does not revolve the contact discs 2-3-4. When the key A5 has been given a quarter turn and is released, the

mechanism causes it to revolve back to its normal position. As the key A5 begins to return to its normal position the mechanism causes contact discs 2-3-4 to make one complete clockwise revolution as shown by the arrows, and as these discs are fixed on the same shaft it is evident that projections 8-9-10 will reach their respective contact springs 11-12-13 at successive intervals. A make and break results from the engagement of projections 8-9-10 with their respective contact springs 11-12-13 which causes a series of positive and negative impulses that are transmitted to the line L by means of the line relay F as follows: The three teeth of projection 8 engage with contact spring 11 causing three impulses to flow from the storage battery B through coil 14 of line relay F causing a like number of positive impulses to be transmitted from the generator G through contact points F_1 F_2 to the line L and the selectors J_1 J_2. In a similar manner the two teeth of projection 9 engage with contact spring 12 causing the two impulses to flow from the storage battery B through the coil 15 of line relay F, causing a like number

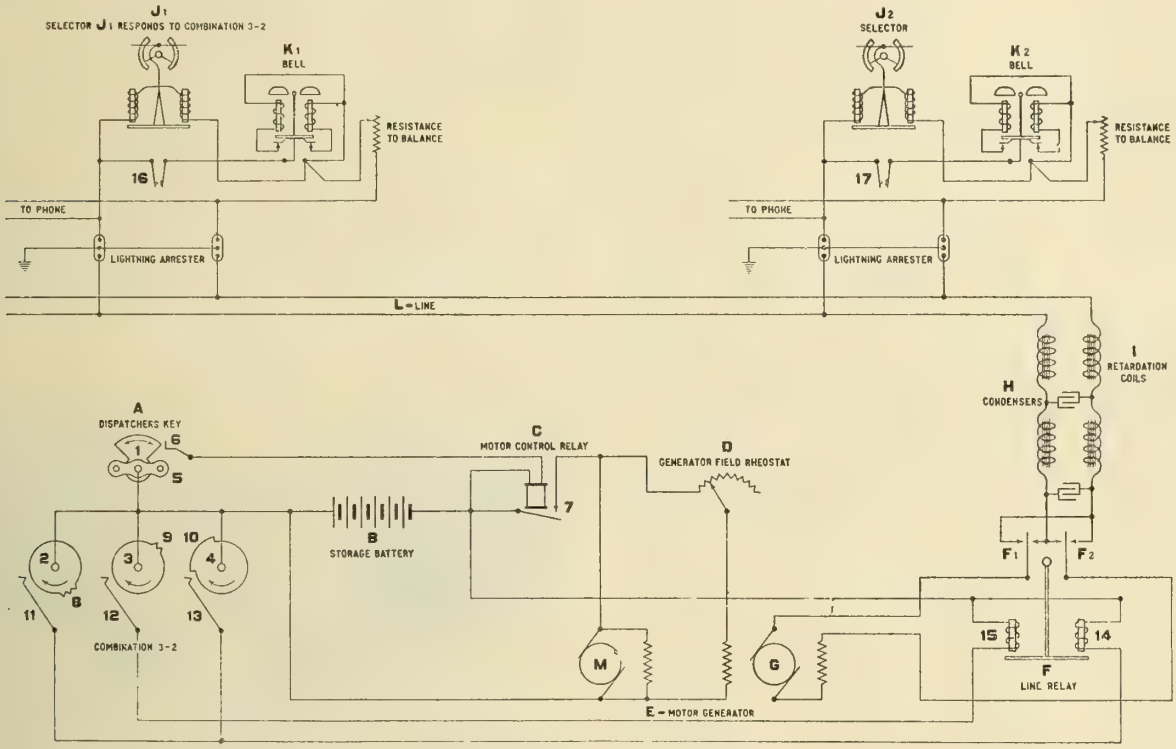


Fig. 3 Typical wiring diagram for selector circuit.

of negative impulses to be transmitted from the generator G through contact points F_1 F_2 to the line L and the selectors J_1 J_2.

This series of impulses, three positive and two negative, being the proper combination to operate selector J_1 will have completed all preliminary movements in this selector, (as will be described in the succeeding paragraph) so that when projection 10 makes contact with contact spring 13, and one long positive impulse is transmitted to the line L and to selector J_1, the depending plunger arm B Fig. 2 of the selector, closes contact 16, this selector being adjusted to combination 3-2 and the bell rings.

Referring to the selector in Fig. 2. The toothed sectors are operated from the armature by means of an arm A and a pawl and rachet mechanism, the engaging dogs of which are pivoted at the top end of the arm A and extend to the right and left, engaging the teeth on the circumference of the sectors. A depending plunger arm B revolves on the shaft supporting the sectors and is attached to the sector on the right, so that the movement of the sector and the arm B is uniform.

Depending contact arm C also revolves on the shaft supporting the sectors and is attached to the sector on the left, so that the movement of this sector and the contact arm is uniform.

A positive impulse attracts the right end of the armature which moves arm A and the engaging dog to the left and plunger arm B to the right, this raises the sector on the right, one tooth.

A negative impulse attracts the left end of the armature which moves arm A and the engaging dog to the right and contact arm C to the left. This raises the left sector one tooth.

As the right and left sectors are raised, the plunger arm B and contact arm C move downward at each impulse until both arms are in line with the proper bell contact D or E. These are the preliminary operations mentioned in a preceding paragraph when as stated, the plunger forces contact arm C against the selector contact, closing a circuit from the line to the bell.

The bell rings while projection 10 is in contact with spring 13. When this contact breaks, there is no potential in the line L, the pawls holding the toothed sectors in the selectors are released and the several parts are restored to the normal position by gravity. An instant latter contact 6 is broken by the key A5 and its sector 1 returning to the normal position. This de-energizes motor control relay C causing its armature to drop and break contact 7 which opens the circuit between the storage battery and the motor M of motor generator E which comes to a stop.

Condensers H and retardation coils I are placed in the circuit to lessen the noise in the telephone receivers caused by the impulses. With these elements in the line, conversation can be carried on while a call is being sent.

The projections on the contact discs 2 and 3 on each key are arranged so that there is but one such combination on the circuit and as the impulses transmitted to the line depend on the projections on the contact discs 2 and 3, it is evident that each key transmits a distinct series of impulses. Conversely, each selector is adjusted to respond to its proper key. If a selector was provided with six working contacts to operate six bells, it would be necessary to provide six keys in the key cabinet to operate this selector.

Electric Railways

Gas-electric Car Operating on Vancouver Island

The Victoria and Sydney Railway, a short line operating on Vancouver Island has now been using a self-propelled gas-electric car with satisfactory results for some weeks. The car is making 110 miles per day, and on two days of each week handles a 30-ton trailer. The car is 4 ft. 8½ in. gauge, weighs 51 tons, and is equipped with two motors, each of 100 h.p. capacity. The total length is 70 feet 7⅜ inches; the length of the passenger compartment is 9 feet 11 inches, and the baggage compartment 10 feet 11⅞ inches; the length of the cab is 11 feet 11 inches; total between bolster centres is 51 feet 6 inches; the wheel base is 6 feet 10 inches and the diameter of the wheel is 33 inches; total wheel base of the car is 57 ft. 11 inches. The body is built almost entirely of steel. The gas engines consist of a two-cylinder, 4-cycle gasoline engine with two integral air pumps directly connected with the lighting generator and an 8-cylinder, 4-cycle main engine supplied with low tension-magneto and air starters. The main generator is of the multi-polar commutating pole type, direct connected to the main gasoline engine. The auxiliary lighting generator is of the multi-polar compound wound type and is direct connected to the auxiliary engine. The motor equipment consists of two G.E. 600 volt, series, commutating pole railway motors mounted directly on the axle of the forward truck, with nose suspension.

Track Construction in Ottawa

The Ottawa Electric Railway Company operate 55 miles of track in the city of Ottawa and suburbs. Within the city limits the track is practically all 7 in. Tee, Lorain section, 80-335. Under the company's franchise the city lays and maintains all street pavements, the company paying an increased mileage rental for paved streets occupied by its tracks. Most of the paving in the city is asphalt; with 6 in. sandstone block on the track allowance. The city paving specification calls for 6 inches of 1-3-6 concrete between ties, which must be increased to 8 inches directly under the rails. The construction is shown in Fig. 1 6 in. x 6 in. x 8 ft. cedar ties, spaced 2 ft. centres, tie bars 6 ft. centres and continuous joints are used in this construction. Where the company has laid tracks in streets already paved, the construction has been as shown in Fig. 2, the ties being laid on 6 inches of concrete.

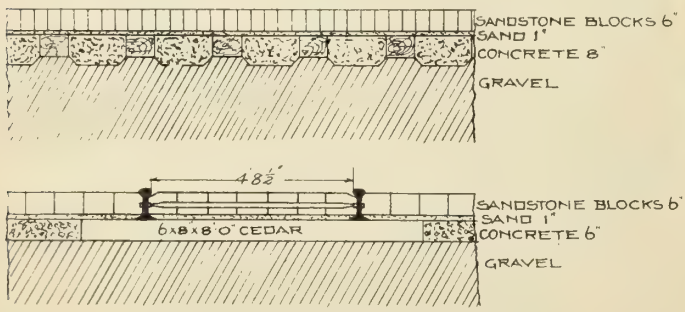
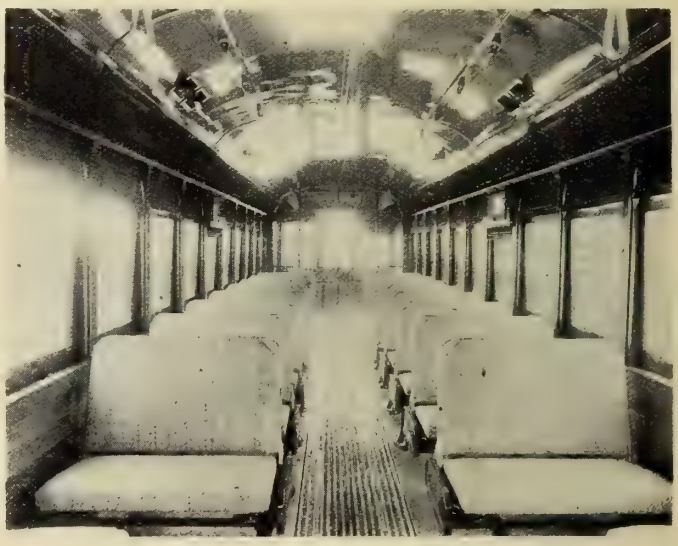


Fig. 1—Track construction, Ottawa.

Toronto's New Municipal Cars

The city of Toronto recently placed in operation, on their St. Clair avenue line, half a dozen cars, of the most modern description, manufactured by the Niles Car Company. This number will be increased to twenty in the near future, half of which will operate on the St. Clair line and half on the Danforth avenue line, which is not yet quite ready for operation.

The new cars are illustrated herewith. They are double truck, double end operation, pre-payment type; the track gauge is 4 ft. 10⅞ inches; the trucks are the Baldwin type with wheel base 6 ft. 3 inches. The motors are C. G. E. number 80, 45 h.p. each, 550 volts, direct current. Four motors are installed on each car, the motor being hung inside the wheel base. The cars are geared for a speed of 30 miles. The wheel diameter is 33 inches, the tread 2½ inches.



Interior Toronto municipal cars, St. Clair Ave.

The length of the car body from the end plates is 31 ft.

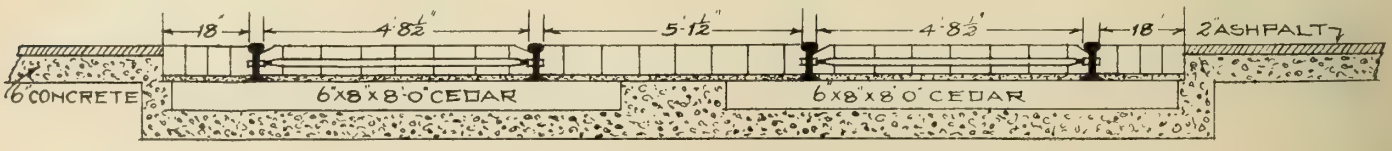


Fig. 2—Track construction on paved streets, Ottawa.



City of Toronto's new municipal cars operating on St. Clair Ave.—One of twenty

1 in.; the front and rear platform is 6 ft. 6 ins.; the length over buffers is 45 ft. 1 in.; the width over sills is 8 ft. 7 ins.; the extreme height from track to top of the trolley base is 12 feet.

The seating capacity is for 48 persons; the main passenger compartment is furnished with 16 cross seats, reversible backs, and four corner seats; the isle is 22 inches wide; the seats are upholstered in standard gray canvas lined rattan. The reversible back seats have bronze corner grab handles, steel pedestals and ends, but no foot rests.

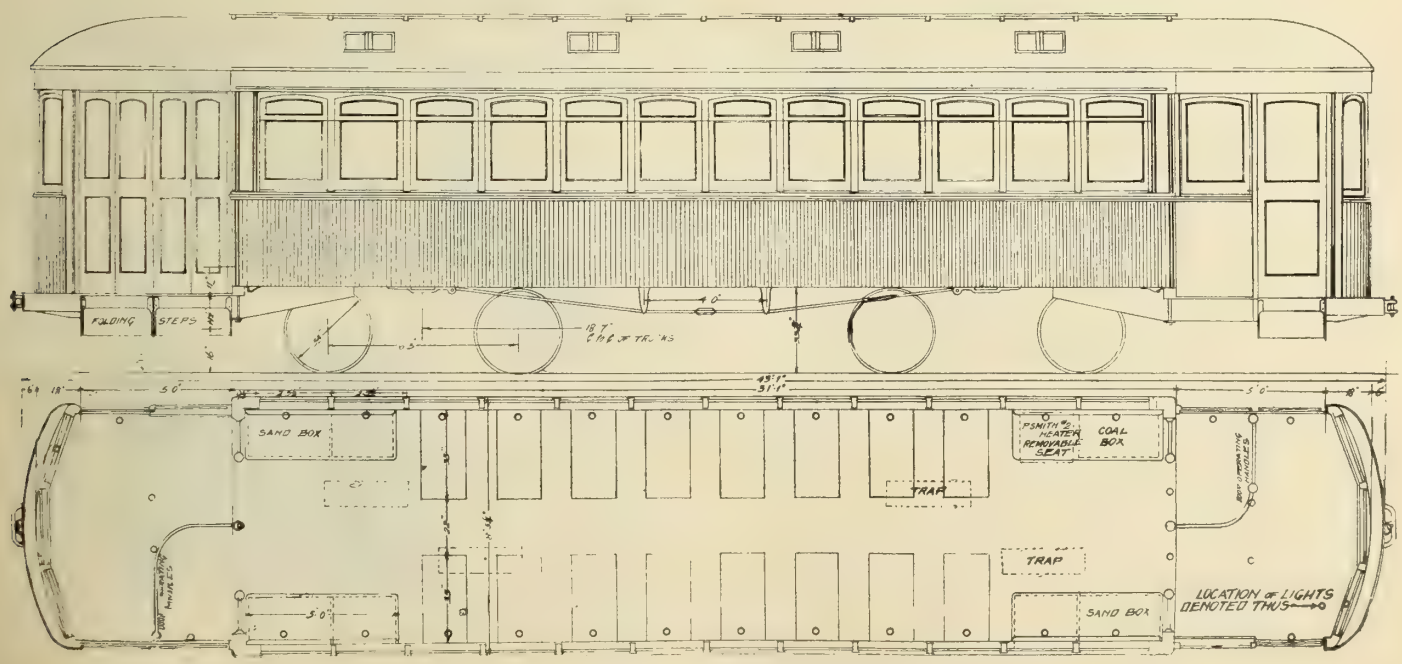
The vestibule floor is depressed below the car floor approximately 11 inches. The roof is of the single arch type extending the full length of the car, with single arch type hood. Eight automatic ventilators—4 on each side—are fitted in the roof.

The cars are equipped for double-end operation, each vestibule being fitted with three doors so that which ever way the car is moving there is one door for exit at the front and one door for entrance and one for exit at the rear. These doors are controlled by levers conveniently placed for the motorman and conductor. The single door at the front is of the sliding type; the rear door fold back well out of the way of the passengers entering or alighting.

The car is lighted with tungsten lamps placed as shown in the plan herewith. Crouse-Hinds type of head lights are installed. A feature of the illumination is the method of lighting the steps. This is accomplished by placing a single lamp just above the step level and under the car so that the full light from one lamp shines on each step when it is lowered. When the steps close up automatically with the doors these lamps are not visible.

Each car is supplied with two trolley catchers of the Knutson No. 2 retriever type. Both hand and air brakes are installed, an air compressing equipment being installed on each car. Each car is also supplied with four Hunter ornamental destination signs, placed one over each vestibule side window and one on each side of the car, near the centre. Sixteen sanitary hand straps are installed in each car opposite the longitudinal seats only. Fenders are of the Watson type.

The Peter-Smith system of hot air ventilation is installed. The cars are painted a dark green color and the letters on the side read "City of Toronto" with the city crest shown prominently in the centre.



Plan of Toronto's new cars—A most modern equipment in every way.

Illumination

Elementary Principles of Illumination

I—Reflection of Light

Light, if unobstructed, travels in a straight line, a single point of light sending out rays in all directions—east, west, north, south, upward and downward to exactly the same extent. Very much of this light is, plainly, lost unless we can devise some means of turning back the rays toward the earth.

When any obstruction is placed in the path of a ray of light, one of three things happens. (1) The ray may be reflected or turned back from the obstruction. (2) The ray may be refracted or simply turned slightly out of its course, or (3) the ray may be absorbed, i.e., destroyed altogether.

Which one of the above conditions is obtained depends entirely on the physical properties of the obstruction placed in the path of the ray, and very much on its surface condition. It follows that one of the important aims of the manufacturer of reflectors is to produce a surface that will prevent the penetration of light rays. The surface must, in general, be hard, highly polished and permanent. The latter factor is especially important, as a surface which deteriorates is apt to become absorptive and, so, a large percentage of the light rays are destroyed.

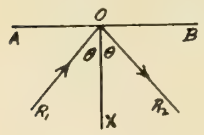


Fig. 1.

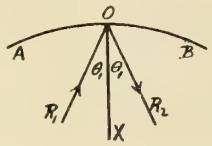


Fig. 2.

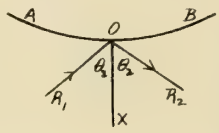


Fig. 3

The law governing the reflection of light is definite but simple. If a ray of light R, meets a reflective surface AB, Fig. 1, it passes out from that surface as R_2 making the angle R_1OX equal to the angle R_2OX where OX is at right angles to AB. The angle R_1OX is called the angle of incidence and the angle R_2OX is called the angle of reflection. Therefore, the law governing reflection of light can be stated simply as follows—the angle of incidence is equal to the angle of reflection. This law is equally true where the reflecting surface is not a plane. For example, in Fig. 2 AB represents the arc of a circle and OX can be drawn so that it is still at right angles to AB at the point O. In this case, just as in the previous one, the ray R_1 passes back as R_2 so that the angle of incidence R_1OX is equal to the angle of reflection R_2OX. Again, AB may have the shape of Fig. 3 with the reflective surface on the convex side; if OX is drawn at right angles to this curve at the point O the ray going in as R_1 will be sent back as R_2 so that the angle of incidence still equals the angle of reflection.

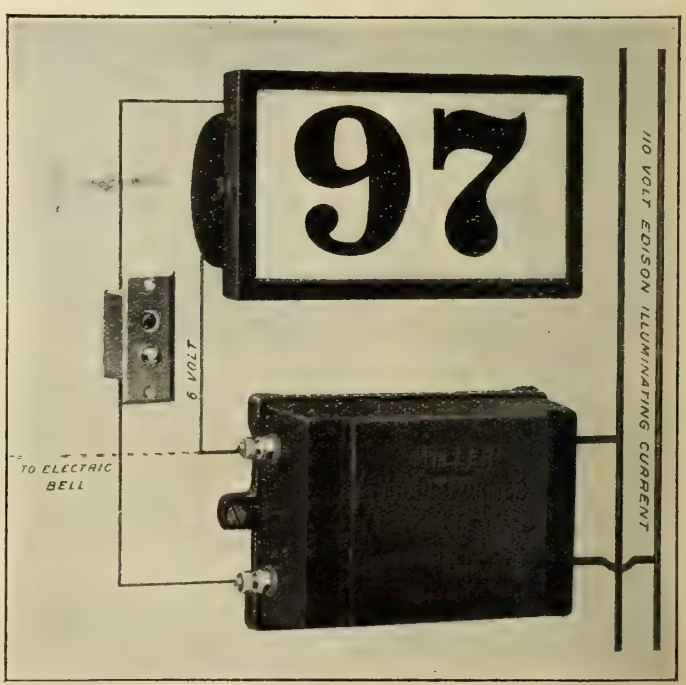
It cannot be emphasized too strongly that this is a law to which there is no exception. The law is not even approximate; it is absolutely exact and unchanging under all conditions of reflection.

It is this law of reflection chiefly that makes the science of illumination possible. By its control we are enabled to turn back the rays that would otherwise pass outwards and upwards and reflect them in such direction that the illumination can be made uniform all over a given area. The very exactness of the law, however, makes care in its control most necessary, and best results are only obtained where the reflectors are constructed with an accuracy comparable with that of the law. It can be easily seen that a single flaw in a reflector will materially alter the distribution of light over the area served. A consideration of these points will lead the purchaser of glassware to appreciate the necessity of installing equipment as accurately and uniformly made as it is possible to obtain.

It will further be seen that the matter of control becomes very much more complicated where the source of light is not a single point. Take, for example, the filament of an incandescent lamp where the source of light may be considered as coming from an almost innumerable number of points. These are all sending out rays, in all directions, which are reflected according to the fixed law given above. The fact, however, that no two lamp filaments are quite the same shape, and that possibly no single lamp is the same on two successive days, indicates how big the propositions are that the manufacturers of reflectors and illuminating engineers have to grapple with.

Illuminated House Number

The Miller illuminated house number illustrated herewith is a new form of illuminated number made by the Dongan Electric Manufacturing Company, 745-747 Franklin



6-volt transformer operating bells, house number, etc.

street, Detroit, Mich. The light is obtained from a 6 volt, 2 candle-power lamp operating in connection with a low voltage transformer. The transformer is attached to the alternating current lighting circuit. In addition to being used for the lamp, the transformer will also operate bells, buzzers, door openers, and annunciators. The power consumption is trifling, the entire wattage being only from three to four watts when the lamp is lighted. The apparatus is furnished complete with number, lamp, transformer and switch.

New Lighting Units

A new type of indirect luminous bowl lighting unit, as shown herewith, has just been placed on the market, by the National X-Ray Reflector Company, of Chicago. In their earlier designs, the luminous feature has been secured by

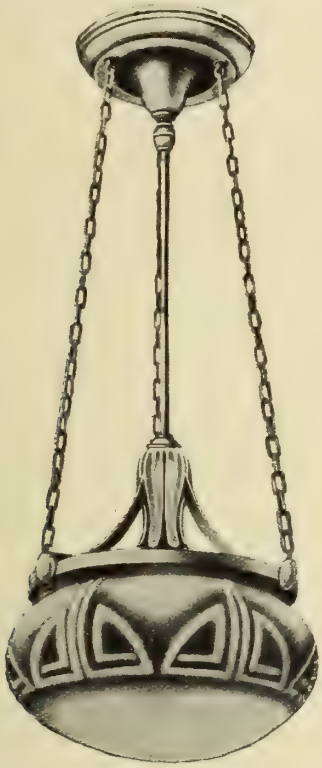


Fig. 1.

using translucent glass-ware in the bowl of the fixture, and illuminating it from within by a small lamp, specially supplied for this purpose. In the new unit the small lamp is dispensed with, and the illumination of the bowl is supplied by

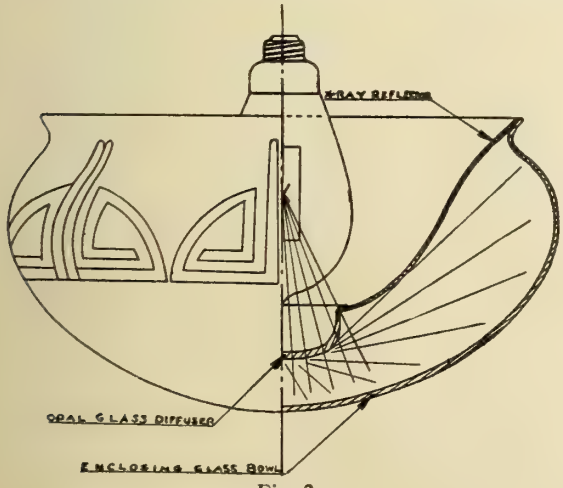


Fig. 2.

light which is permitted to escape through on opal diffuser, placed at the base of the conical reflector, as shown in the line drawing herewith. In no case is it desired to illuminate the bowl to a higher intensity than that of the ceiling, as the only object in illuminating it at all is to make it more pleasing in appearance. Not more than ten per cent. of the total light flux generated is required to secure this intensity and each fixture is designed with this condition in mind.

The possibilities of this arrangement in fitting into decorative schemes is practically unlimited. Color effects may be obtained by means of colored glass-ware, or by coloring the separate lamp, where that is used. The bowl may be hand-painted or decorated in any of the ways known to artisans in this ware. Beautiful combinations may also be built up by using opaque fixtures with art glass panels or by means of leaded bowls of colored glass. Figure 2 shows the equipment of Figure 1 in a bowl designed for bedrooms, but which, if given a brownish tint is most suitable for den or study use.

The final solution of modern lighting problems is two-



Fig. 3.

fold—to supply adequate and proper illumination and to please the senses from a decorative point of view. Both these conditions appear to be adequately fulfilled by the above designs.

A handsome installation of portable lamps is also shown in Fig. 3. This is the new type recently described in the Electrical News, and is designed for the double purpose of supplying an art lamp using indirect lighting and to provide illumination, where desired without wall or ceiling fixtures. Fig. 3 is a view of the tea-room in Hyde Park Hotel, Chicago. In this type of unit the large lamp which supplies the general illumination is enclosed in a standard eye-comfort opaque glass reflector, which directs practically all the light to the ceiling. Below these reflectors small lamps are arranged, frosted or colored if desired, used for the illumination of the silk shade and the surface immediately below the lamp. These lamps are separately controlled so that either may be used alone when desired.

It will be seen from the photograph that the results of using this type of lamp are very effective. Objectionable and harsh shadows are removed and details of the room are well brought out. There is also a note of distinction and comfort rarely found in this class of artificially lighted rooms.

A contract has been awarded to Dawson & Company, Limited, Winnipeg, for ninety ornamental street lighting poles at $110.60 per pole. This contract had previously been awarded the United States Steel Products Company but has been cancelled as they could not undertake to ship in the time specified.

The Dealer and Contractor

Wiring Existing Buildings

By Mr. C. E. Robertson*

The problem of wiring old buildings has two very distinct phases; one the wiring of residences, and the other, the wiring of small stores and business houses. The problem assumes different proportions, depending upon the age of the city served by the central station.

To arouse public interest in the electric equipment of homes, considerable thought should be given to proper publicity.

The advertising booklets of the large manufacturers of lamps and heating devices are stirring up considerable public interest, and some of the larger lighting companies are putting out through their publicity departments quite a varied assortment of descriptive literature, explaining how easily and economically old houses may be electrically equipped. Some of this descriptive matter is undoubtedly excellent; on the other hand, a number of the circulars and booklets are very poor and will serve to defeat the efforts that are being made to standardize good practice in electric wiring.

For example, the following is an extract from one of the booklets issued by a large eastern company:

"The fixture of the dining room too, may be utilized for light cooking. Here with a combination electric grill, small steaks may be broiled, eggs fried or boiled and bread toasted. Delicious coffee can be cooked on the electric percolator, and so on—this booklet is far too small to adequately describe the many other labor and time saving cooking devices that an electric light service brings to your dining table."

The purpose of a lighting fixture should not be corrupted in the minds of the public by any such extravagant promises as the above, nor is it good practice to attach heating devices on the efficient dining room fixture that is suitable for the use of Mazda lamps. A serving table, with baseboard outlets of ample capacity back of it is the only reasonable piece of dining room equipment on which light cooking operations should be attempted. The poorer class of customers, who could not afford this arrangement, would, in all probability, have a combined kitchen and dining room, and no kitchen should today be without one or more baseboard receptacles.

Proper publicity of a wiring campaign is so essential to its success, and its continued success, that we should be extremely careful not to hold out false promises to prospective customers; and especially is this true when we consider that the average electrical contractor, whom we are all trying to educate and co-operate with, looks to the practice of the lighting company as an example of what to do.

Publicity in a store-wiring campaign is a much simpler proposition, in that the average small merchant understands the value of effective illumination in the display of his wares, and also the advertising value of an electric sign and well lighted windows in attracting the attention of the people passing his shop.

A lamp socket is designed to care for the base of an incandescent lamp, and it is short-sighted policy to encourage the use of heating or motor driven appliances from lighting fixtures, especially when the lighting circuits are laid off usually with number fourteen wire and twelve sockets in the circuit. The matter of drawing up specifications for heating appliance wiring should be given the earnest consideration of the manufacturers, lighting companies and contractors. In Baltimore it has been the practice since the beginning of the residence wiring campaign to give free with each old house wiring job, a separate heating circuit of number twelve wire with a twenty ampere outlet in the kitchen, and making only a nominal charge for additional outlets, which may be accepted by the customer upon recommendation of the salesman.

The distribution of lighting outlets and the arrangement of switch control have been sufficiently well standardized to pass over with a brief comment on the influence of the Mazda lamp on lighting fixture design, and (because of its being rated in watts) its effect in simplifying wiring layouts for a sufficient and well distributed amount of illumination.

The Selling End

The selling end of the wiring of existing buildings is the most interesting part of the subject to the sales manager, and the question can be sub-divided as follows:

Shall the lighting company do the selling?

Shall it be left in the hands of the contractors?

Should a co-operative arrangement be made whereby both contractors and lighting companies are in position to sell wiring on standard specifications which would substantially standardize the selling price?

All three ways have been, or are being tried and the results obtained will be interesting matters for discussion. To the lighting company in a large city, with only a small percentage of existing buildings wired and using service, the temptation is very strong to get out after the business, and obtain a large volume of this class of wiring as quickly as possible, if it can be done on a self-supporting basis. The activity of the lighting company along these lines naturally creates a demand, and a greater demand, than would be created if the matter were left entirely in the hands of the contractors, and the latter naturally benefit in the securing of orders from prospects created by the efforts of the lighting company. Some of the contractors, of course, will strenuously object to the encroachment on their field by the lighting company, but if the efforts of the company are restricted to the securing of wiring orders from prospects whose houses have never been wired, the more intelligent contractor with an established business does not complain, but looks upon it more as a stimulus to the business generally. It is usually true that people who are skeptical as to the safety of equipping their houses electrically, will have more confidence in the work of a large responsible corporation than in that of a small irresponsible contractor.

If the lighting company leaves the problem entirely in the hands of the contractor, it is bound to be handled in a slip-shod manner, unless an incentive is given to the contractor by subsidizing him, as the Cleveland company does,

*Paper read before the Sales Managers' Convention at Association Island,

and unless the lighting company, through the medium of the contractor, can offer to the public easy terms of payment covering a period of twelve months or more. This is true because the larger contractors, who have a substantial credit, are looking to new work in large buildings in which class there is not the element of speculation that exists in small old houses both in the matter of profit and of receiving the money for the job when it is completed. Failure to collect accounts receivable when due has been the cause of the failure of a considerable number of electrical contractors. The average small householder, in making improvements to his home, requires easy terms of payment, and there are comparatively few electrical contractors, as yet whose businesses are well enough established to permit them to offer deferred payment terms; then, too, if such terms were offered, it is essential that competing contractors for this class of work should add to their selling prices a sufficient percentage to cover the interest on the money tied up. Wide variance in the estimates submitted by several contractors on the wiring of an existing building, proves conclusively, that the element of chance is appreciated by only a few. On one job in Baltimore, on which half a dozen contractors submitted bids, the prices varied from $200 to $800. A prospective customer receiving such bids is bound to be at a loss in awarding the contract, and generally asks the lighting company for advice. This sort of bidding hurts the wiring business generally, as it estabishes a doubt in the mind of the prospect as to the character of work that is permitted. Some of the older contractors hesitate to bid in competition on this class of work, and will take the business only on a time and material basis. The smaller contractors have not the capital invested to enable them to successfully advertise, nor to successfully solicit the business in sufficient volume to satisfy the lighting company.

Co-operate With Central Station

If, on the other hand, the central station company has an established wiring department, and has managed it on a self-supporting basis with satisfactory results as to the volume of business obtained, it is not difficult to make an arrangement with those contractors who find the wiring of old houses profitable, which will enable them to offer their prospects the same deferred payment terms as offered by the lighting company. As an incentive to these contractors, the lighting company may agree to pay them for each complete old house installation, the order for which with service application, to be turned in to the office of the lighting company, an amount depending upon the average cost to the company of securing the same class of business through its own sales organization.

The price at which wiring orders can be taken in a given city by both the lighting company and a group of responsible contractors must be worked out on a fair average basis for each class of wiring undertaken. This is quite an undertaking and necessitates the employment of a man who is capable of estimating the cost accurately, and who has sufficient experience in the wiring business to know how much it costs a contractor to conduct his business. The best method of arriving at proper selling prices for wiring is to obtain from accurate cost records the average unit cost for labor and material for each class of wiring. The question of what unit to adopt is still an open one. In the majority of cases, the first conclusion is to adopt the outlet as the unit, but the cost of wiring a lighting outlet depends upon the number of lights to be burned at that outlet, and for a switch outlet upon whether the switch is a single pole, double pole, three-way or four-way, and how many lighting outlets are to be controlled by it. Similar conditions apply to baseboard outlets and floor outlets. In the writer's judgment the proper segregation would be to use a unit price for ceiling, bracket and baseboard lighting outlets, a unit price for switch outlets and a unit price for appliance outlets. If each of these unit prices is arrived at from average costs and the addition of a gross profit on the cost of 33 1/3 per cent., they will prove satisfactory in the majority of cases to both the contractor and the lighting company. With the use of the Mazda lamps, the cost of wiring a lighting outlet depends upon the total number of watts to be consumed at that outlet, or the average number of outlets in a group constituting a full circuit of 660 watts.

In considering this question in Baltimore, we went to the very foundation of the cost element and established an average price per watt wired for, using a unit price for single-pole switches, a unit price for pairs of three-way switches, and a unit price for a group of two three-way, and one four-way switches. By adding 33 1/3 per cent. to the average cost, we expected to make an average gross profit of 25 per cent. on the selling prices.

The influence of the circuit cost on the outlet cost is a refinement of the problem that necessitates very complete detailed data, in order to make fair prices to two neighbors occupying the same size and the same style of house, one requiring more wattage because of his willingness to make a greater investment in the fixtures and shades—having greater light absorption properties—than the other, therefore requiring more circuits for the same number of outlets.

The cost of the service wiring from the meter loop through to the center of distribution should be absorbed in the first circuit. This will make the average cost per lighting outlet, for the minimum number of lights, greater than for the outlets over and above the first circuit.

In Baltimore, where it has been the practice to give a heater circuit free, we have also pro-rated the cost of this circuit over the outlets in the first lighting circuit.

The circular dial attached hereto has been arranged for the convenience of the wiring salesmen and the prices shown are based on the average costs as obtained from 175 jobs completed by the company. It will be noted that these prices cover installations up to and including 35 outlets on 6 circuits. For larger jobs the price per watt, as given in the salesmen's hand books are used. The prices for switch outlet wiring and other fittings are given on the back of the dial.

Two-storey seven-room houses built in rows are typical in Baltimore. The following estimate is given for wiring for 11 outlets with 21 lights, including a free heater outlet in the kitchen and service entrance as required by the rules of the company:—

Price for outlet wiring (from dial)	$43.25
Price for one single pole rotary	3.00
Price for seven single pole flush switches	24.50
Price for 2 sets of three-ways	15.00
Total Billing Price	$85.75
Cost of job:—	
Material	$38.60
Labor	25.00
Car Fare	.60
Auto Expenses	.45
Total Cost	$64.65
Gross Profit	21.10

Contractors generally figure on 20 per cent. profit and base their approximate estimates on $3.50 per outlet for ceiling outlets, and $4.50 per outlet for wall outlets.

For the above sample house, the approximate price which a contractor would give would be as follows:—

11 Outlets at $3.50	$38.50
1 Spr Switch	3.00
7 Spf Switches	28.00
2 Sets 3-Ways	11.00
Total	$80.50

The price quoted would range from $60.00 to $90.00, depending on the amount of competition.

We are now co-operating with the contractors by turning over to them, daily, a list of prospects that are secured by our street appliance canvassers. To those contractors who have signed a bonded agreement with us we offer to finance house wiring jobs, paying the full amount of their bill, less 6 per cent. in 30 days after completion of the work and we billing the customer direct in a twelve-monthly-payment basis. Those contractors turning in a complete house wiring order with service application we pay $5.00 to, provided the customer had not received an estimate from our wiring salesmen within 60 days prior to the taking of his order. This plan seems to be working out very nicely and is resulting in a better feeling on the part of the contractors, generally, toward the company.

New Combination Flush Receptacle

A new combination flush receptacle is being manufactured by the Arrow Electric Company of Hartford, Conn. The receptacle may be used interchangeably with plugs for standard receptacles on the market, and has the added advantage of being adapted for use with a "Polarity Plug." A grove in the receptacle permits the insertion of the polarity plug in one position only, while it does not interfere with the insertion of the standard plug. The receptacle is rated at 12 amperes, 250 volts. This polarity feature is of great advantage where fixed polarity of current is necessary, as in the use of electrically driven machines and storage batteries.



Receptacle



Standard Plug.



Polarity Plug.

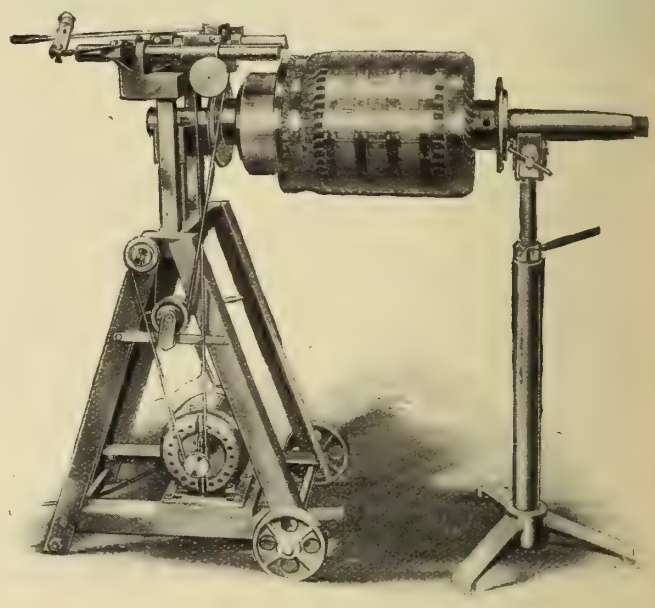
New P. & S. Devices

Pass & Seymour, Incorporated, are just placing on the market a new devise, illustrated herewith, namely, keyless, pull and key receptacles respectively. The base of these receptacles is covered with brass, making a very neat and graceful appearance. These are additions to the Fluto interchangeable receptacles manufactured by this company.



Portable Slotting Machine

A new portable commutator slotting machine is being sold by the Electric Service Supplies Company to meet the demand for a portable machine that is properly built and capable of the highest class of rapid and accurate work. The illustration shows this machine complete with an armature mounted in position. It is adjustable for armatures of varying lengths and diameters, and is capable of handling from the smallest air compressor commutator to those of 18-inch diameter and of any practical length. This machine is easily handled and carried from place to place, so that it is frequently more advantageous to take the machine to the armature, than vice versa. The commutator end of the armature shaft is supported in a V-bearing, which is adjustable in height to suit the diameter of the commutator so as to bring the cutting saw to the proper depth. This saw is clamped by a nut to the spindle, which runs in a long bearing bolted to the sliding head. The bearing is removable and is cheaply replaced when worn. The sliding head is carried by two shafts projecting over the commutator, and is moved over the slots by the lever, as shown in the illustration. The pivot positions of the operating lever can be changed and adjusted to suit the size of the commutator. The lever is placed at a convenient height for the average operator to accomplish the quickest and best results. The other end of the armature shaft is supported by a special stand which may be adjusted in height according to the diameter of the commutator and to bring it level with the cutter. An extremely valuable feature is embodied in the stand in that it is adjustable crosswise so as to bring the travel of the saw always in line with the mica slots. This adjustment is of great importance because the mica frequently does not run true with the shaft. This portable commutator requires a ⅛ horsepower motor to operate but may be used as a stationary tool by dispensing with this and belting direct to the counter or line shaft. The weight of the machine proper without the motor is 148 pounds. The weight of the rear support is 35 pounds.



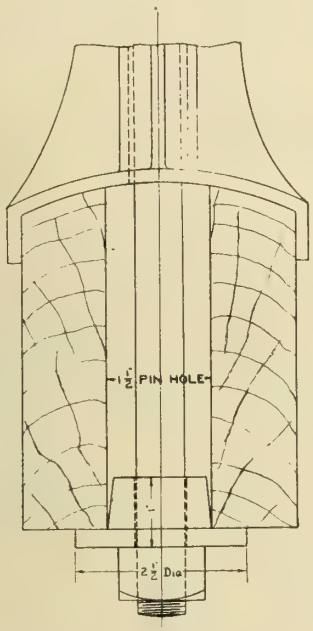
Portable commutator slotting machine.

The Ontario Railway and Municipal Board have been experiencing a good deal of trouble in obtaining the necessary returns from the different independent telephone companies throughout Ontario. The secretary of the board has now sent out a circular to the delinquent telephone companies advising them that unless their returns are made promptly the board will impose the penalty clause in the telephone act which provides for a fine of $25 for this offence.

Copies of the 1913 edition of the National Electric Code are being distributed by the Canadian Fire Underwriters' Association, Montreal. The new edition embodies alterations recommended by the National Fire Protection Association, and copies may be obtained by applying to Mr. Tate, the chief electrical inspector of the Underwriters' Association.

Adapter Cross Arm Washer

A washer or bushing of special design has been placed on the market by the Electric Service Supplies Company for use in connection with their Keystone truss pins. The function this washer performs can readily be seen in the accompanying illustration. When used in conjunction with these Keystone truss pins they readily adapt the cross-arm hole of 1½ inches diameter so that an iron truss pin having a curved



Special design bushing.

base, as shown, may be used. This adapter makes possible replacing wooden truss pins with iron pins without placing new cross-arms. The benefits to be derived can be appreciated when difficulties such as running a heavy feeder over an old line or the necessity of having pins of greater strength at curves are considered. In either case it has been found unnecessary to change the cross-arms or bore new holes. This method of installation is also practical for complete renewals of line truss pins.

Canadian General Electric Takes Over the Stratford Mill Building Company

Some time since the Canadian General Electric Company acquired by agreement with the Allis-Chalmers Company of the United States the right to manufacture and sell exclusively in Canada their various lines of manufacture. The Canadian General Electric Company at their various works have sufficient equipment for manufacturing most of the apparatus for which these rights were acquired, such as hydraulic machinery, sawmill machinery, mining machinery, etc., but had no equipment for the manufacture of flour mill machinery, grain elevator equipment, etc., such as manufactured by the Allis-Chalmers Company. In order to be fully equipped to take care of all business offering in this line, the Canadian General Electric Company have just acquired by purchase all the plant and assets of the Stratford Mill Building Company, at which plant in future will be manufactured not only the well-known lines of the flour mill machinery heretofore manufactured by the Stratford Mill Building Company, but also the wider range of machinery and equipment as produced by the Allis-Chalmers Company. Mr. William Preston, who has been the president of the Stratford Mill Building Company, will continue actively identified with the flour mill machinery business as manager of the flour mill machinery department of the Canadian Allis-Chalmers Company.

The Burnham Engineering Company

A recent change in Canadian engineering circles is brought to the attention of the readers of the Electrical News by an announcement on another page of this issue, viz.: the severing of his connection with the firm of Messrs. Kilmer, Pullen & Burnham, by Mr. George C. Burnham, and the formation of The Burnham Engineering Company, Limited, with Mr. Burnham as president, and Mr. L. J. Belnap of the Rudel-Belnap Machinery Company, of Montreal, as vice-president. This new company has been fortunate in securing the agency of the Amalgamated Electric Company of Sweden, whose reputation as builders of high grade electrical machines has for years been well established throughout Europe, their plant at Ludvike, Sweden, being of a most efficient design and layout. Their products comprise a complete line of electrical generators, motors and transformers, switchboards, switching equipments, etc., and also electric heating appliances. The Amalgamated Electric Co. are also the first to put on the market an electric iron ore smelter. Messrs. Burnham and Belnap have been connected for some years with engineering schemes throughout Canada, and their past record is a sufficient guarantee of the success of the new enterprise.

A New Sign Idea

The Dennison sign shown in the illustration is unusual in that it is illuminated by Cooper-Hewitt lamps instead of by the ordinary incandescents, which are so generally used. In addition to being very brightly illuminated this sign has a distinctive color—the light emerald green characteristic of this lamp. The letters are made of wood, painted white and mounted on a frame work of galvanized iron pipe. The capital letters are 10 feet high and the small letters 5 feet. The illumination is accomplished by eight lamps, each enclosed in a galvanized iron box with glass door, the lamps



Sign Illuminated by Mercury Lamps.

being equipped with a specially designed reflector which directs the light so as to cover the entire surface of the letters. The sign is 80 feet long and the total wattage is 1380, only about half the amount, it is claimed, that would be required to properly illuminate this sign with incandescent bulbs.

The Half-Watt Lamp

The 34th convention of the Association of the Edison Illuminating Company was held in Coopertown, N.Y., September 8 to 12, the registration list reaching a total of 360. An interesting exhibit was that of the new "one-half watt" tungsten lamp. This new lamp is filled with nitrogen gas and ranges in size from 500 to 5,000 candle power. The smaller units are naturally less efficient, specific consumption being about .75 watts per candle power, but in the 5,000 candle power size, an efficiency of .5 watts per candle has been obtained. One of the speakers at the convention also told of results which he had obtained with a neon lamp. One of these lamps was exhibited and gave out an orange-red light with the specific consumption of about .5 watts per candle.

The municipality of St. Remi, P.Q., has just installed a small system of electric lighting, power being supplied by a local firm.

City Will Supply Assiniboia

The hearing of the application of the city of Winnipeg to supply light and power to the municipality of Assiniboia, took place on August 29th before Judge Robson, public utilities commissioner. A decision granting the application was handed down. This decision simply confirms one of the charter rights of the city of Winnipeg, but as the city and the municipality could not agree on the establishing of poles, etc., through the latter, the matter was referred to the public utilities commissioner. At the hearing the city was represented by Theo. A. Hunt, K.C., City Solicitor, and the municipality of Assiniboia by E. L. Taylor, K. C. Reeve Bannatyne of the municipality was also present.

The question of the right of the city of Winnipeg to sell electric energy in St. Boniface for light, heat and power purposes came up before Commissioner Robson of the Manitoba Public Utilities Commission, September 2nd. The formal application of Assistant City Solicitor Prudhomme was heard and the commissioner adjourned the hearing until Monday next. The evidence will then be taken and the defence put in. The proposition of the city of Winnipeg is being objected to by the city of St. Boniface and the Winnipeg Electric Railway Company.

W. E. R. Co. Acquiring More Power Facilities

According to a published interview with Sir William McKenzie on his return from abroad, it is understood that what are known as the Reese interests have been taken over by the Winnipeg Electric Railway Company. The business of the latter company has increased to such a point that the peak load is much higher than the water plant capacity and for this reason the Reese properties were taken in.

Trade Publications

Adjustable Speed Motors—Bulletin number A4130—issued by the Canadian General Electric Company on adjustable speed direct current motors.

Annual Report.—The Ontario Railway and Municipal Board have just issued their 7th annual report covering the year ending December 31st, 1912.

The Textile Quarterly—Number 4—issued by the Westinghouse Electric and Manufacturing Company, on the subject of motor drive in the silk industry.

Electricity on the New York Central—A booklet issued by the Canadian General Electric Company, describing the electrical equipment on the New York Central system.

The Lighting of the Home.—A booklet published by the National X-Ray Reflector Company, being a re-print from the Fine Arts Journal, on the subject of correct illumination in the home.

Curtis Steam Turbines—Booklet Number A4137, issued by the Canadian General Electric Company, describing and illustrating their Curtis steam turbines in capacities ranging from 100 to 2,500 kilowatts.

Wiring Specialties—Catalogue number 16—on the wiring specialties manufactured by the Arrow Electric Company, of Hartford, Conn. This is a catalogue of ninety-six pages completely illustrated.

Electric Hoisting Plants—Catalogue 3002A, issued by the industrial and power department of the Westinghouse Electric and Manufacturing Company, on the selection of motor equipment for electrically operated hoists.

Gear Cases—The Electric Service Supplies Company are mailing a series of five booklets covering the details embodied in the manufacture of their Keystone Steel Gear Cases. These booklets describe the gear case under the several heads—Steel, Tightness, Brackets, Fit, and Weight.

Voltage Regulators—Bulletin No. A4129, issued by the supply department of the Canadian General Electric Company, descriptive of small feeders and voltage regulators. The bulletin deals at some length with the proper layout of distribution systems and explains the theory and mechanism of this type of regulator.

Parian Ware—Catalogue No. 35, issued by Gill Bros. Company, of Steubenville, Ohio, describes, with illustrations, a number of their direct, semi-indirect and indirect lighting fixtures. The Canadian General Electric Company are Canadian agents for this product.

Linotype Machines.—Descriptive Leaflet No. 3698, issued by the Westinghouse Electric & Manufacturing Company, covers motors for driving Intertype and Linotype machines. The characteristics necessary for this service are explained and application views shown of motors driving these machines.

Magnetic Switches.—Descriptive Leaflet No. 3351, issued by the Westinghouse Electric & Manufacturing Company, describes alternating-current magnetic switches known as the Type F. These switches are designed to withstand the severest forms of industrial service. They are fully described and illustrated in this leaflet.

Arc Lamps—Bulletin No. A4035, issued by the supply department of the Canadian General Electric Company, descriptive of series luminous arc lamps. The catalogue is well illustrated and explains in detail the mechanism of the lamps, and the illumination curves of the various types, and gives descriptive information regarding a number of actual installations.

Metal Reflectors.—Bulletin No. 30, just issued by the Holophane Company, describes the Holophane-D'Olier metal reflectors for lighting of mills and factories. This bulletin describes at some length the value of correct illumination and illustrates diagramatically a number of scientific principles, outlining correct practise in the selection and installation of proper reflectors.

The Textile Quarterly—issued by the Westinghouse Electric & Manufacturing Company, is, as its name indicates, a publication issued every three months devoted to the use of electricity in the textile industry. The cover is a unique reproduction of a piece of linen. This particular issue is devoted to motor drive in the silk industry, and a number of interesting motor applications are shown.

"Selecting Motor Equipment—for Electrically Operated Hoists," is the title of a Bulletin (Section 3113) just issued by the Industrial Power Department of the Westinghouse Electric & Mfg. Company. This pamphlet gives a quantity of good interesting data and information on the subject of hoisting equipment. A number of formulae applying to this work are given, together with a number of examples. A diagram of connections of different systems are given, and the bulletin has a question sheet for securing data on installations of this kind.

The Toronto Electric Light Company have recently purchased 2200 h.p. of Riley Self-Dumping Underfeed Stokers. These stokers are to be used in a stand-by steam station as a reliability reserve for the power from Niagara Falls. These boilers will carry banked fires week in and week out and must always be ready to pick up the load instantly in case of any transmission line trouble. The reciprocating movement of the grates which slice the fire of the Riley stoker is so well adapted to quick steaming that a boiler at the Narragansett Electric Light Company recently showed 300 per cent. of rating in 6 minutes from a fire that was banked for twenty-four hours.

Current News and Notes

Aurora, Ont.

Tenders have been called for the supply of motor-driven pumps and auxiliary equipment.

Brampton, Ont.

The town council recently passed a by-law authorizing the expenditure of $15,000 for the extension of their electric system.

Brantford, Ont.

The following tenders in connection with the Brantford street lighting system have been accepted—152 ornamental cast-iron standards, to be supplied by the Ornamental Lighting Pole Company; 152 magnetite lamps including cut outs and regulators, the Canadian General Electric Company; two 750 kv.a. transformers, Canadian Crocker-Wheeler Company; recording instruments, Canadian Westinghouse Company; high and low tension switch and control equipment for sub-station, Canadian General Electric Company. A pulmotor is also being purchased.

The city has won its case against the Brantford street railway system and has been awarded tax arrears of some $27,000. The franchise is also to be annulled unless certain necessary extensions and improvements are carried out within twelve months.

Calgary, Alta.

Superintendent McCauley's annual statement for the year ending June 30th, 1913, shows net earnings of $64,492.

The proposition to extend the street railway system to Shaganappi Park is meeting with favor. Certain property owners in this vicinity promise to pay the entire cost of the extension and guarantee operating costs for the first four years.

The City of Calgary have recently placed an order with the Imperial Wire & Cable Company, Limited, Montreal, for lead covered paper insulated underground cable. Approximately 40,000 feet will be installed by the city, under the supervision of Mr. R. A. Brown, city electrical engineer.

Charlottetown, P. E. I.

The city recently passed a resolution offering to buy out the plant of the Charlottetown Light & Power Company, and operate it as a municipal enterprise. The franchise of the company has still eight years to run. The capacity of this plant is 500 k.w., a.c., consisting of two units, one steam and one gas driven. Generation is at 133 cycles, single and two phase, 1,100 volts. The suggested price is $96,000.

Dundas, Ont.

The town has taken over the street lighting system and will make a number of improvements and additions. The equipment will include wire, brackets and lamps.

Edmonton, Alta.

September 15 was the day set for the inauguration of a service on the Edmonton Interurban Railway Company's system between Edmonton and St. Albert. A self-propelled car is being used.

Esquimalt, B.C.

The B. C. E. R. Co. have completed the installation of an electric lighting system in this municipality and 75 lamps are in operation.

Fergus, Ont.

It is planned by the Hydro-electric Power Commission of Ontario to supply Fergus and Elora with 400 h.p., the line being run out from Guelph. It is calculated that the rate to these towns would be $33.67 per h.p. per year, the price at Guelph being $22. A by-law to the amount of approximately $10,000 will likely be submitted in each town.

Fort William, Ont.

The corporation of the city of Fort William offers a special rate for cooking purposes at 1½ cents per kilowatt hour. This rate is subject to the minimum charge of $1 a month plus 25 cents meter rental. The rate for domestic and commercial lighting in Fort William is 5 cents per kilowatt hour with 10 per cent. discount. Power is sold to motor users at 4 cents with 10 per cent. off, or on a flat rate of $25 per h.p. per year, net.

Galt, Ont.

It is announced that the light and power consumers in Galt are now increasing at the rate of one a day, there having been 252 additions this year up to the middle of September. Two years ago there were 455 costumers as compared with 1,350 at the present time.

Lacombe, Alta.

A contract has been awarded to the Canadian Westinghouse Company for a number of 6.6 ampere series arc lamps; also a number of tungstens to be placed in series, with necessary hoods, regulator, regulator panel and instruments.

Lethbridge, Alta.

An agreement has been signed between the Lethbridge municipal railway system and its employees. The following wage schedule was accepted:—1st six months—25 cents per hour; 2nd six months, 28 cents per hour; 2nd year—30 cents per hour; 3rd year—32 cents per hour. On public holidays the men are paid time and a-half, and on Sunday on the basis of 9 hours pay for 7½ hours work.

Medicine Hat, Alta.

In addition to the unit which is at present being installed, the power committee of the town council are considering the wisdom of placing an order for another generator.

The city of Medicine Hat is at present installing a high tension sub-station for transforming the current to 2,000 volts. The building is a reinforced concrete construction with hollow tile faced with brick curtains. The contract for the construction work has been awarded to Sackrider & Turner for $10,000. The electrical equipment is being supplied by the Canadian General Electric Company. The station is expected to be ready for operation on November 30th.

Montague, P. E. I.

The Montague Electric Company of Montague, P. E. I., are building a reinforced concrete flume and dam, which will necessitate the removal of about 2,000 yards of rock and earth and the construction of a quantity of heavy masonry. No electrical equipment will be required at the present time.

Montreal, Que.

The Bell Telephone Company have awarded the contract for a new telephone exchange in St. Urbain.

The city of Montreal contemplate the purchase of a number of standards for the police and fire department.

The following is the tentative programme for the winter session of the Montreal Electrical Society, arranged by Mr. P. T. Davies, chairman of the papers committee: Mr. G. M.

Gest, "The Conduit Situation in Montreal"; Mr. B. T. MacCormick, of Canadian Allis Chalmers, "Induction Motors"; Mr. L. E. Hamilton, Northern Electric and Manufacturing Company, "Fire Alarm Systems"; Mr. A. E. Reoch, Marconi Wireless Telegraph Company of Canada, "The Marconi System"; Mr. Cole, Canadian Allis Chalmers, "Transformers."

Plans are being submitted and tenders will likely be called shortly for 225 single standards with lamps.

The Montreal Water and Power Company are building a second transformer house, 20 x 40, at their plant in Point St. Charles. The company are supplied with power by the Montreal, Light, Heat and Power Company at 2,200 volts, the same company also supplying the transformers—three of 1,000 k.w. each. It is proposed to build a duplicate line and also to duplicate the transformers and other equipment, the water company constructing the transformer house. The duplicated plant is intended for use in case of emergency.

Alderman J. Robinson, of Montreal, was re-elected president of the Dorchester Electric Company, at the annual meeting held in Quebec. Hon. N. Garneau, Quebec, is the vice-president, and Mr. W. T. Wilson, managing director. The directors are: Messrs. Gustav Proteau, Quebec; L. A. Cannon, K.C., Quebec; Jos. Gosselin, Quebec; G. E. Tanguay, Quebec; C. P. Beaubien, K.C., Montreal, and F. Gold Lyman, Montreal.

Although the annual statement of the Quebec Railway, Light, Heat and Power Company shows an increase in gross receipts of $108,375, the total being $1,524,200, there is a rise in operating expenses of $160,255, making a decrease of $51,880 in the net earnings. Miscellaneous income is higher by $42,297, but on the other hand fixed charges increased by $131,737, the surplus of $73,801 showing a falling off of $141,320. The surplus of $72,801 for the year added to the amount brought forward on June 30th, 1912, brings the total surplus up to $147,341. The sum of $27,641 was received from the Dominion Government on account of subsidies and was applied to the cancellation of $30,000 bonds according to the trust agreement. At the annual meeting it was stated that $91,500 had been expended on maintenance during the year and that the various properties and plants of the road and its subsidiaries had been maintained at a high state of efficiency. A revision of the by-laws was authorized by the meeting reducing the number of directors to six, the new board now consisting of Sir Rodolphe Forget, M.P., president; Hon. Robert Mackay, and Messrs. J. N. Greenshilds, K.C., Lorne C. Webster, Paul Galibert and D. O. Lasperance, M.P. The retired directors are Hon. J. P. B. Casgrain, Messrs. L. C. Marcoux and O. B. d'Aoust.

Mr. William Ile, Canadian manager of the George H. Shuman Electric Company, Montreal, is about to pay a visit to the principal European countries, with a view of purchasing a number of Christmas novelties.

A contract has been awarded the Imperial Wire & Cable Company, Limited, Montreal, by the Toronto Hydro-Electric System, for approximately 22,000 feet of 2 and 3 conductor paper insulated lead covered underground cable, conductors ranging from No. 6 B & S to 500,000 C.M.

The Canadian British Insulated Company, Limited, Montreal, have taken out patents for paper insulated lead covered cables. The patented device consists of a spiral wrapping of aluminium tape over which is one lap of paper. As is well known, great difficulties have been experienced in detecting the presence of moisture due to a defect in the lead in extra high tension cables, and in some cases months have elapsed before moisture has disclosed itself by causing a blow-out. In order to obviate this difficulty and enable the engineer to feel the pulse of his cable the company have introduced this open sheathing, by the use of which the presence of moisture is immediately detected by measuring the insulation resistance between the lead and the metallic tape.

About fifty members of the Montreal Electrical Society on September 20th visited the Angus Shops of the C. P. R. They were received by Mr. Moody, the superintendent, and Mr. J. A. Shaw, the electrical engineer. The visitors were divided into parties, and were shown around the immense works by several gentlemen who acted as guides. The entire shops are motor driven, a steam plant being installed, and in addition current is supplied by the Montreal Light, Heat and Power Company. One of the chief points of interest was the power-house, where are also situated the Ingersoll Rand compressors. The C. P. R. have a special department for manufacturing and repairing batteries and automatic dynamos for lighting their cars; while there is also a shop for electrical welding.

Neepawa, Man.

On September 17th a by-law was passed authorizing the expenditure of $18,000 for the extension of the electric light system.

Ottawa, Ont.

The city of Ottawa have placed an order with the Imperial Wire & Cable Company, Limited, Montreal, for the supply and installation of 47,000 feet 3 conductor No. 2/0 B & S paper insulated lead covered cable, and 1,100 feet 3 conductor No. 2/0 B & S steel taped cable, both insulated for 3,300 volts.

Owen Sound, Ont.

It is expected that the council will shortly close a contract with the Hydro-electric Power Commission of Ontario for the development of Eugenia Falls on Beaver river. It is now calculated that this Falls can supply 1,400 h.p. without storage and 4,000 h.p. with storage facilities. The requirements of Owen Sound at the present time, however, would not exceed 800 h.p. for which a $31 rate has been quoted by the commission.

Prince Albert, Sask.

A by-law was recently passed authorizing the expenditure of $275,000 on the erection of an auxiliary steam plant. Mr. Raymond Wright is superintendent of the light and power department and the work will be carried out under his supervision.

Regina, Sask.

Tenders are called till October 25th for one 3,000 kw. steam turbine with condenser and one 25-ton hand-power crane.

Souris, Man.

Tenders have been received for the supply of equipment necessary to establish an electric light and power plant at Souris, Man. Two direct-current 50 k.w. generators are required; a storage battery and switchboard; also equipment for street lighting, including a certain amount of underground work.

Swift Current, Sask.

Tenders have been called for the construction of a new power house.

St. Catharines, Ont.

Conferences have been held between representatives of the C. P. R. and the city council regarding the construction of an electric railway connecting Hamilton and St. Catharines. It is understood a preliminary contract has been drafted to be submitted to the electors if approved by the C. P. R. officials.

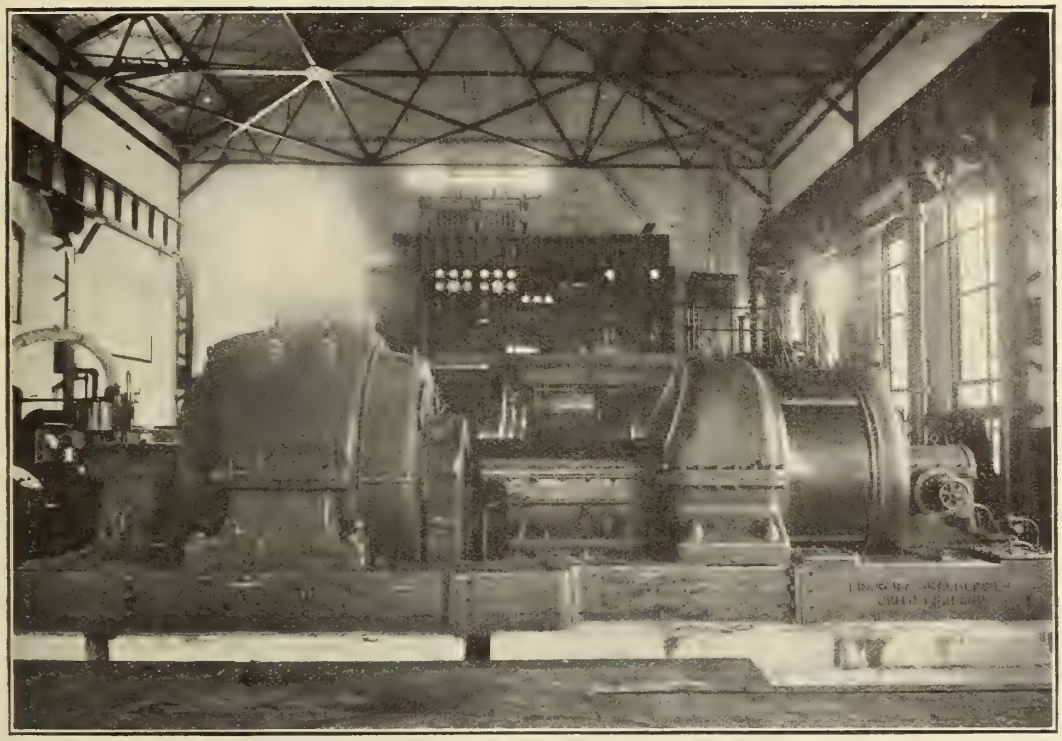
The Hydro-electric Power Commission estimate the cost of the step-down sub-station and distributing system, with all

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SIEMENS



Siemens 2500 K.W., 25 Cycle, 6600 Volt Turbo Generator with Switchboard, supplied to the Dominion Coal Company, Nova Scotia.

The following Siemens Turbo Generators have been supplied or on order for Canada:—

1-4000 K.W. Edmonton
1-2500 K.W. Dominion Coal Company
3-2000 K.W. Dawson City
1-2000 K.W. Edmonton
2-1500 K.W. Regina
1-1500 K.W. Lethbridge
1-1500 K.W. Moose Jaw
1- 750 K.W. Nova Scotia Steel & Coal Company
2- 750 K.W. Medicine Hat
2- 500 K.W. Nova Scotia Steel & Coal Company
1- 500 K.W. Wayagamack Pulp & Paper Company

The Siemens Companies have supplied more than 100 Turbo Generators of 4000 K.W. or over.

Siemens Company of Canada, Limited

HEAD OFFICE:

Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

the necessary equipment, at approximately $90,000. A by-law will be submitted in the near future.

St. John, N.B.

It has been decided to instal a system of telephone despatching between St. John and Moncton, N.B., on the Intercolonial Railway, and tenders have been invited for the necessary equipment. The automatic block system will be introduced at the same time.

Thorold, Ont.

The Beaver Board Company of Thorold are installing two 1,200 h.p. 250 r.p.m., 2,200 volt motors for operating grinders. The contract for these motors, as also for the switchboard, has been awarded to the Canadian General Electric Company.

Toronto, Ont.

Weiss & Biheller (Canada) Limited, importers of electric shades, indirect lighting fixtures, etc., have vacated their offices on the second floor at 21 Richmond St. W., Toronto, for more commodious and recently remodeled show-rooms on the ground floor at 19-21 Richmond St. W.

Truro, N.S.

At the beginning of the present year a representative council was elected who have carefully studied the situation and have decided to install a street and public building municipal lighting plant. Though their conclusion was reached only three or four weeks ago a large number of poles have already been erected and negotiations are in progress for all other requirements.

The electrical equipment needed consists of one 50 kw., a.c. generator; switchboard and accessories, including meters, switches, circuit breakers, etc.; distributing transformers; insulated wire, insulators, cross-arms, etc.; 400 or more street lighting fixtures, including 36 -in. goose necks, with reflectors, brackets, etc.

Vancouver, B.C.

The new directory just issued by the British Columbia Telephone Company contains 27,355 names. This includes the lower mainland, Agassiz to Ladner, but does not include Chilliwack or Mission City or the rural line to Lulu Island or the Delta which are owned by separate companies. In Chilliwack there are 600 subscribers and in Mission 135 so that the total number of telephones on the lower main line is over 28,000. Of this number 23,506 are in Vancouver.

A new agreement has been reached between the B. C. E. R. Co. and their employees, fixing the scale of wages for the next two years.

Windsor, Ont.

It is said that some negotiations have taken place between the mayors of Windsor and Detroit in reference to the supply of Niagara power for municipal purposes in Detroit.

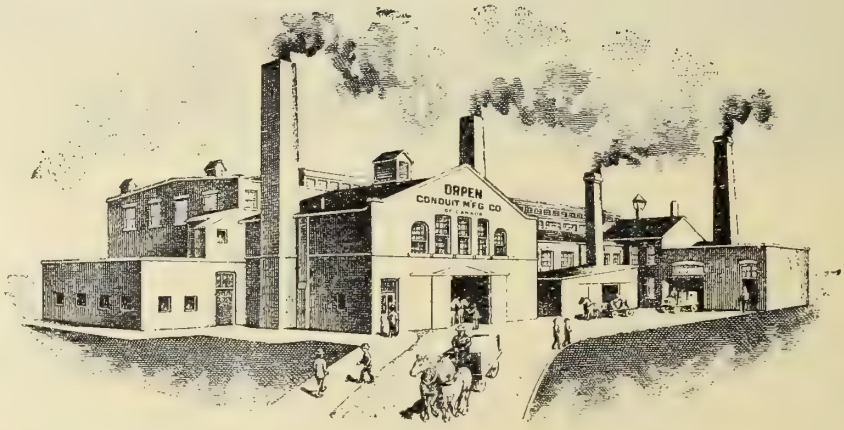
Woodstock, Ont.

The Hydro-electric Power Commission of Ontario will give a demonstration on threshing and corn-cutting by electricity on a number of farms in this vicinity.

Manitoba Branch C. S. C. E.

A meeting of the Membership Committee of the Electrical Section of the Manitoba Branch of the Canadian Society of Civil Engineers took place on September 5th, Although the last winter session was a most successful one and was enthusiastically attended, it is planned to set a new record this winter, both in point of attendance and papers read. An active campaign for new members will be waged this fall.

The home of XCELADUCT and ORPENITE CONDUITS



Queen and Dufferin Streets TORONTO

"XCELADUCT"

"Xceladuct" is a high grade of galvanized conduit made of easy-bending spellarized steel tubing, doubly protected against rust by copper plating and zinc coating. Every length is made up with clean threads and smooth enameled interior, allowing easy and rapid fishing.

INTERIOR

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MANUFACTURERS OF
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Let us send Prices and Samples

"ORPENITE CONDUITS"

"Orpenite" Enameled Conduit is made of easy-bending spellarized steel tubing which is protected against rust and proof against all temperature conditions by coatings of specially prepared enamel. Each length presents clean threads and a smooth interior permitting of easy and rapid fishing.

CONDUITS

THE ORPEN CONDUIT MANUFACTURING COMPANY of CANADA

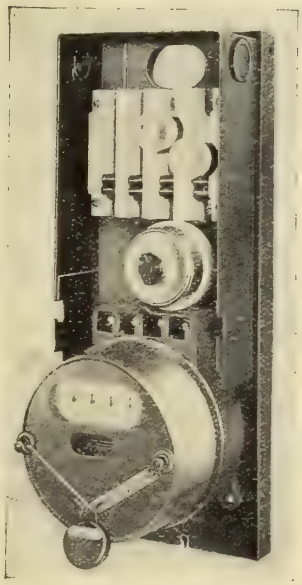
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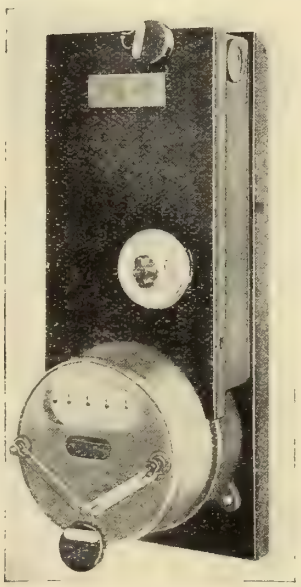
Mr. K. L. Aitken, formerly General Manager of the Toronto Hydro-Electric System, and under whose direction the System was designed, constructed and placed in operation, begs to announce his return from Europe and the re-establishment of his practice as Consulting Engineer.

Temporarily, letters may be addressed in care of the Toronto Hydro-Electric System, 226 Yonge Street, Toronto, Canada.

We have devices suitable for any Metered Service.



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Device Sealed and Complete.

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90 Sherbourne Street - - TORONTO

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

WANTED—Resident agents and salesmen in cities and territory on commission basis wanted by manufacturer of the largest line of Automatic Electric Beer Pumps, Air and Garage Pumps. Responsible, experienced dealers preferred. Address Varwig Mfg. Co., Cincinnati, O. 19-20

CITY OF REGINA, SASK.

Sealed tenders, registered and clearly marked on the outside of the envelope "Tender for Power House Equipment," and addressed to the City Commissioners, Regina, Saskatchewan, will be received up until noon of October 25th, 1913, for the supply of: —

One 3000 K.W. Steam Turbine with condenser.

One 25 ton capacity, hand power crane for 45 foot span.

Specifications may be obtained from E. W. Bull, Superintendent of Light & Power Dept., Regina, Saskatchewan.

A marked cheque for 5 per cent. (5 p.c.) of the amount of bid must accompany tender.

The City Commissioners reserve the right to reject any or all tenders. 18-19

FOR SALE

Lights		Speed
2	450 Gen. Elec. type C. form T, direct-connected to Curtis form A non-condensing turbine, 100 lbs. pressure, 25 kw., 125 volt.	3600
2	450 Gen. Elec., 6-pole, form L, 25 kw., direct-connected to Westinghouse vertical gasoline engines	350
1	540 Gen. Elec., 6-pole, form F, comp., 30 kw. direct-connected to 11 x 8 in. Gen. Elec. vertical marine type engine, 125 volt	305
1	1300 Northern, MP, 75 kw., comp., direct-connected to Racine vertical cross comp. engine, 125 volt	275
1	1300 Westinghouse, 6-pole, comp., 75 kw., direct-connected to 14 x 14 Ames auto, center-crank horizontal engine, 125 volt	275

Send for our "Monthly Bargain Sheet" showing complete list of machines on hand with net prices. Every machine sold is completely overhauled and fully tested at our works before shipment, and is sent out practically "as good as new."

We Buy, Sell, Rent, Exchange and Repair.

GREGORY ELECTRIC CO. CHICAGO, ILLINOIS

Established 1893.

1601 S. Lincoln Street. 14-t.f.

For Sale—16 long burning and enclosed, 60 cycle A.B. arc lamps, 40 light A.B. regulator and 12 C.G.E. enclosed lamps. Wanted within 6 months, 400 kw. 60 cycle generator. Cataract Electric Co., Ltd., Orangeville, Ont. 18-19

Moonlight Schedule for October, 1913

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. of Hours
Oct. 1	6 10	Oct. 2	5 10	11 50
2	6 10	3	5 20	11 50
3	6 10	4	5 20	11 50
4	6 10	5	5 20	11 50
5	6 10	6	5 20	11 50
6	6 10	7	5 20	11 00
7	10 00	8	5 20	7 20
8	11 00	9	5 20	6 20
10	0 00	10	5 20	5 20
11	1 10	11	5 20	4 10
12	2 00	12	5 30	3 30
13	3 00	13	5 30	2 30
14	No Light	14	No Light	
15	No Light	15	No Light	
16	No Light	16	No Light	
17	5 40	17	7 40	2 00
18	5 40	18	8 20	2 40
19	5 40	19	9 00	3 20
20	5 40	20	10 00	4 20
21	5 40	21	11 10	5 30
22	5 40	23	0 20	6 40
23	5 40	24	1 30	7 50
24	5 40	25	2 50	9 10
25	5 40	26	4 10	10 30
26	5 30	27	5 20	11 50
27	5 30	28	5 40	12 10
28	5 30	29	5 40	12 10
29	5 30	30	5 40	12 10
30	5 30	31	5 40	12 10
31	5 30	Nov. 1	5 50	12 20

Total Hours 220 50



Franklin Prismatic Reflectors

Tungsten Lighting

All Kinds of Illuminating Glassware

High Efficiency, Decorative, Indirect, Plain, Common

GILLINDER & SONS, INC.

135 OXFORD STREET, PHILADELPHIA

SHOW ROOMS: NEW YORK CHICAGO SAN FRANCISCO

ASK US about Efficient Lighting

for your streets, factory, warehouse or yard

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"Consult A Specialist"

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for all classes of service correctly designed and properly erected.

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We offer the results of long experience in this sort of work. We design and install power plants for every purpose.

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TEN POINTS of EXCELLENCE

1. The scale is uniform throughout the entire range of deflection.

2. The readings can be made with practically the same precision on violently fluctuating loads as on steady loads.

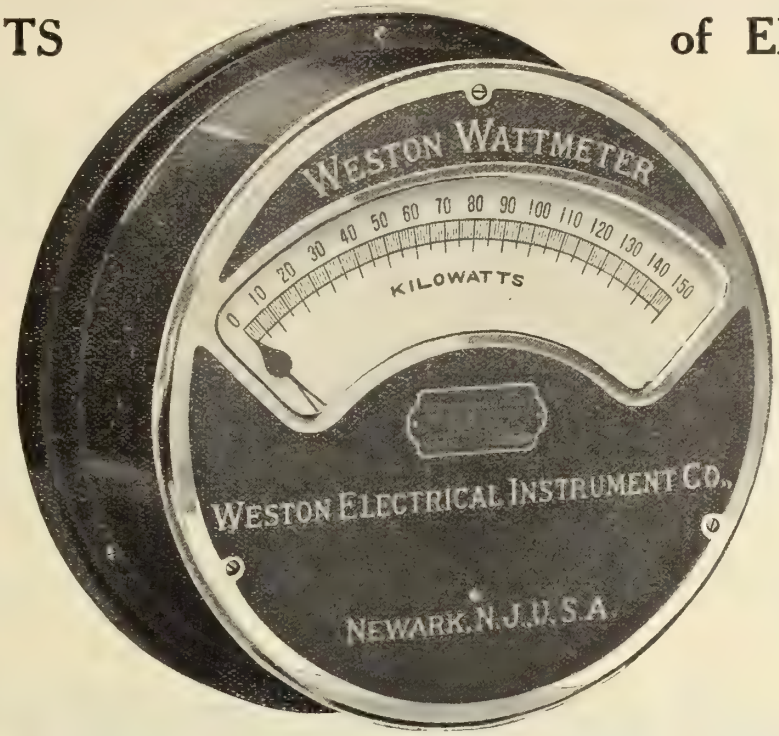
3. The indications are equally accurate on direct-current circuits or on alternating-current **circuits of** any frequency, power-factor or wave form within commercial limits. Therefore, these watt-meters can be calibrated with direct-current and used on alternating-current circuits without change of calibration.

4. The scale is flat and is therefore easily read.

5. The pointer is entirely free from vibration produced by mechanical resonance.

6. The power consumption is extremely small.

7. They have a large overload capacity, which will allow the measurement of full power at power-factors below 0.50.



8. They are far more reliable and durable than any commercial wattmeter heretofore built.

9. They are accurate within the limits of scale reading, regardless of changes in temperature, frequency, power-factor and wave form, within the range of commercial practice.

10. The zero position of the pointer can be adjusted from the outside without removing the instrument from the board.

In the **Weston** switchboard **Wattmeter** every heretofore existing difficulty has been satisfactorily overcome by intelligent design and skillful construction and the results attained with these instruments are far in advance of anything ever accomplished in the art of commercial electrical measurement. Send for catalogue giving full information regarding **our complete** line of **A.C. Switchboard** Indicating Instruments, Voltmeters, Ammeters, Wattmeters, Synchroscopes, Power Factor Meters, Frequency Meters, also D.C. Instruments.

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Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
Detroit, 618 Union Trust Bldg.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Toronto, 76 Bay Street.
Winnipeg, Montreal, Calgary, Vancouver } Northern Electric & Mfg. Co.
London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. George
Berlin, Genest St. 5, Schoeneberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Building, Harrison St.



Power Cables

Manufactured by

British Insulated & Helsby Cables, Limited

PAID-UP CAPITAL, $8,500,000.00

HEAD OFFICE—PRESCOT, ENG. Works at PRESCOT, HELSBY and LIVERPOOL

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

WRITE FOR ILLUSTRATED CATALOGUE

SOLE CANADIAN REPRESENTATIVES:

Canadian British Insulated Co.

LIMITED

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ANNOUNCEMENT

With the active support and cooperation of the Montreal Light, Heat and Power Company,

Montreal Electrical Exposition

A thoroughly representative showing by the manufacturers, dealers and jobbers of electrical supplies and appliances.

ARENA

Montreal Nov. 10th to 15th

Address inquiries to Manager's Office, 910 New Birks Bldg., Montreal

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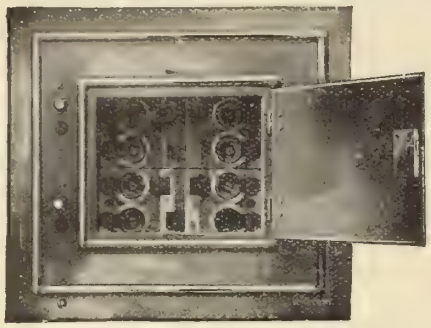
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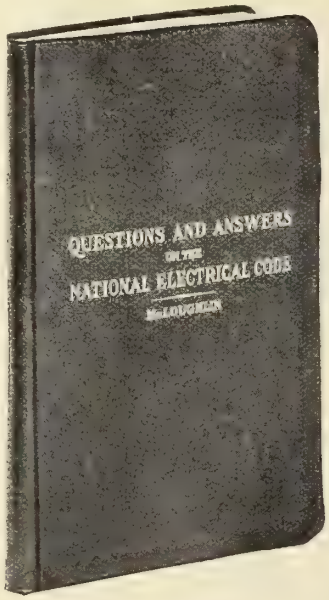
		Prices			
Cat. No.	Circuits	List	Cat. No.	Circuits	List
511	2	$3.50	515	10	$5.50
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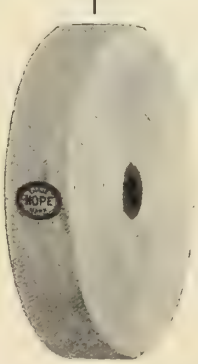
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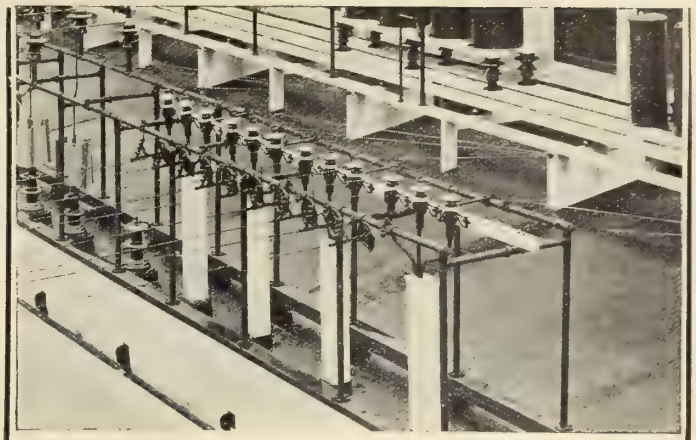
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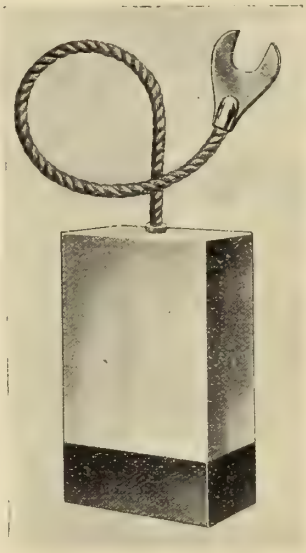
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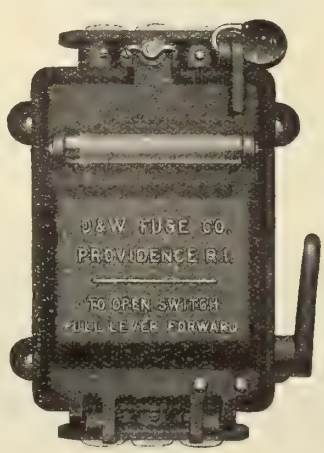
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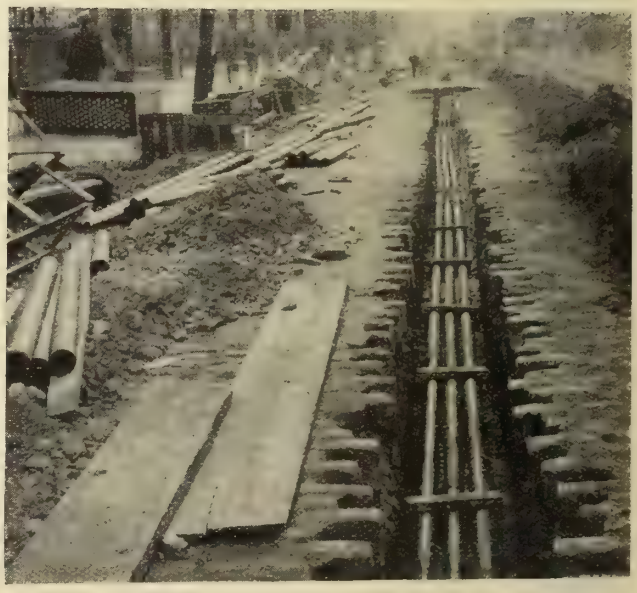
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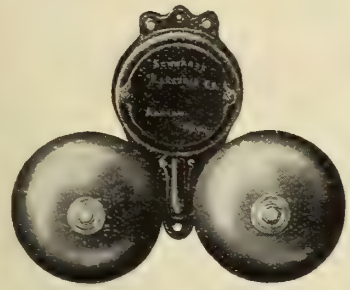
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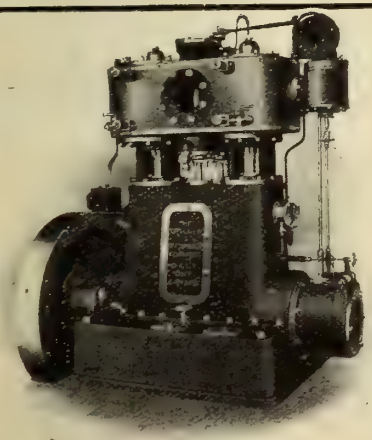
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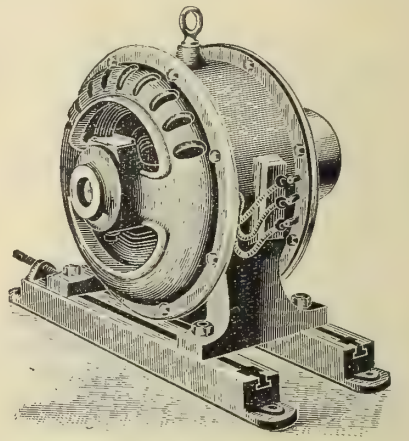
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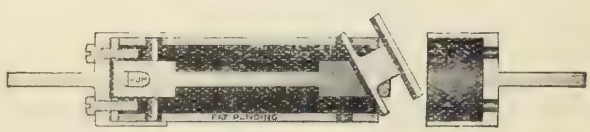


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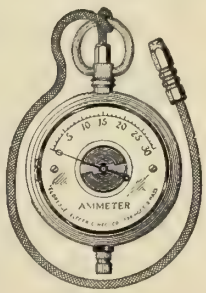
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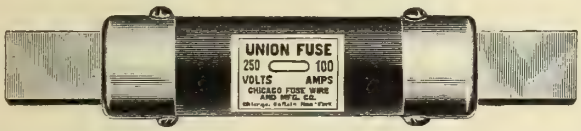
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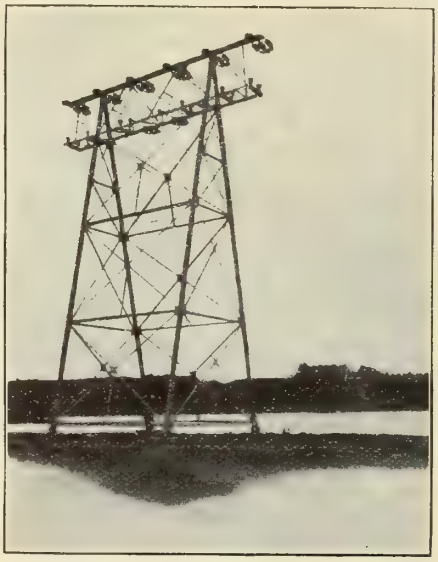
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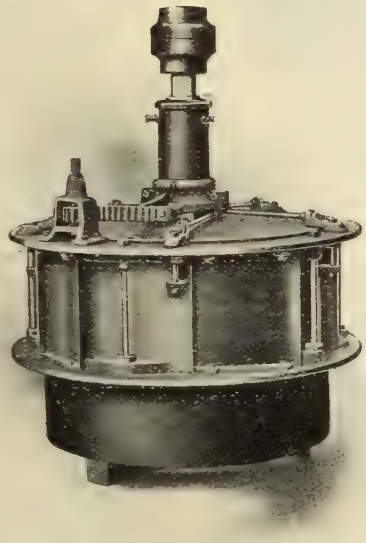
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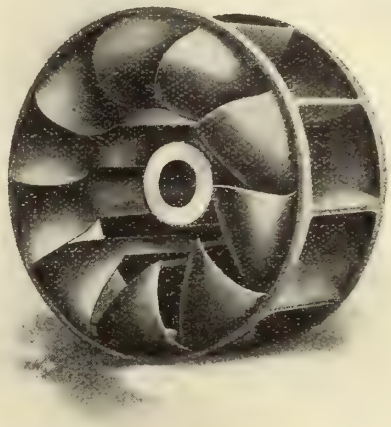
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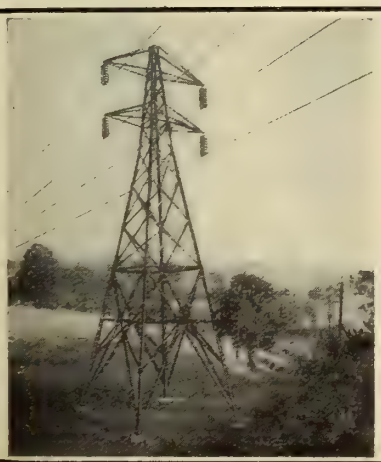
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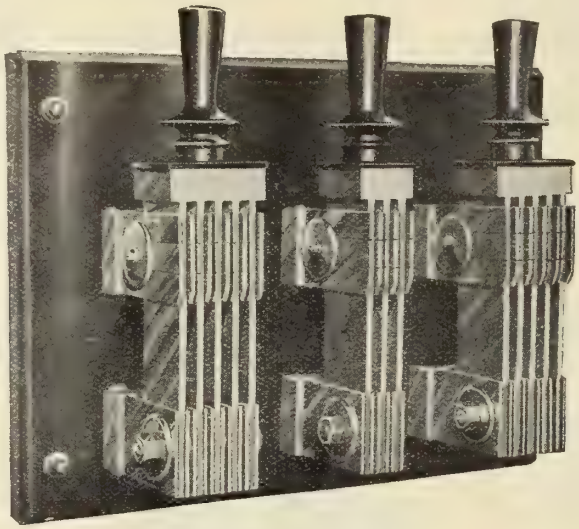
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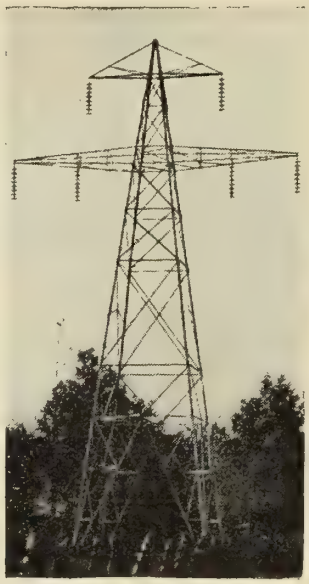
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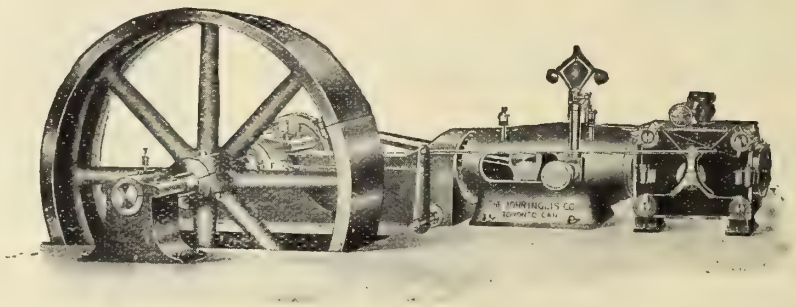
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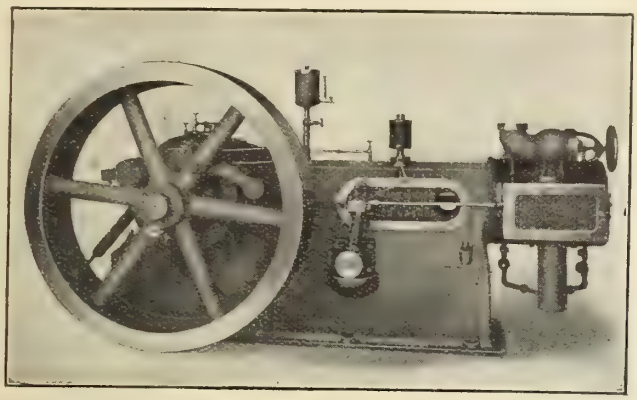
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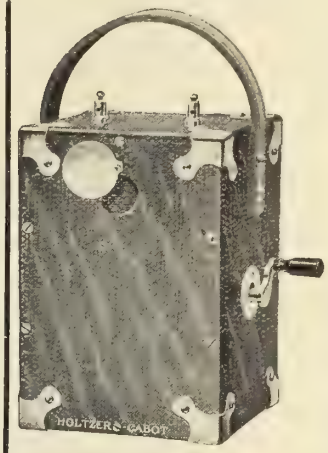


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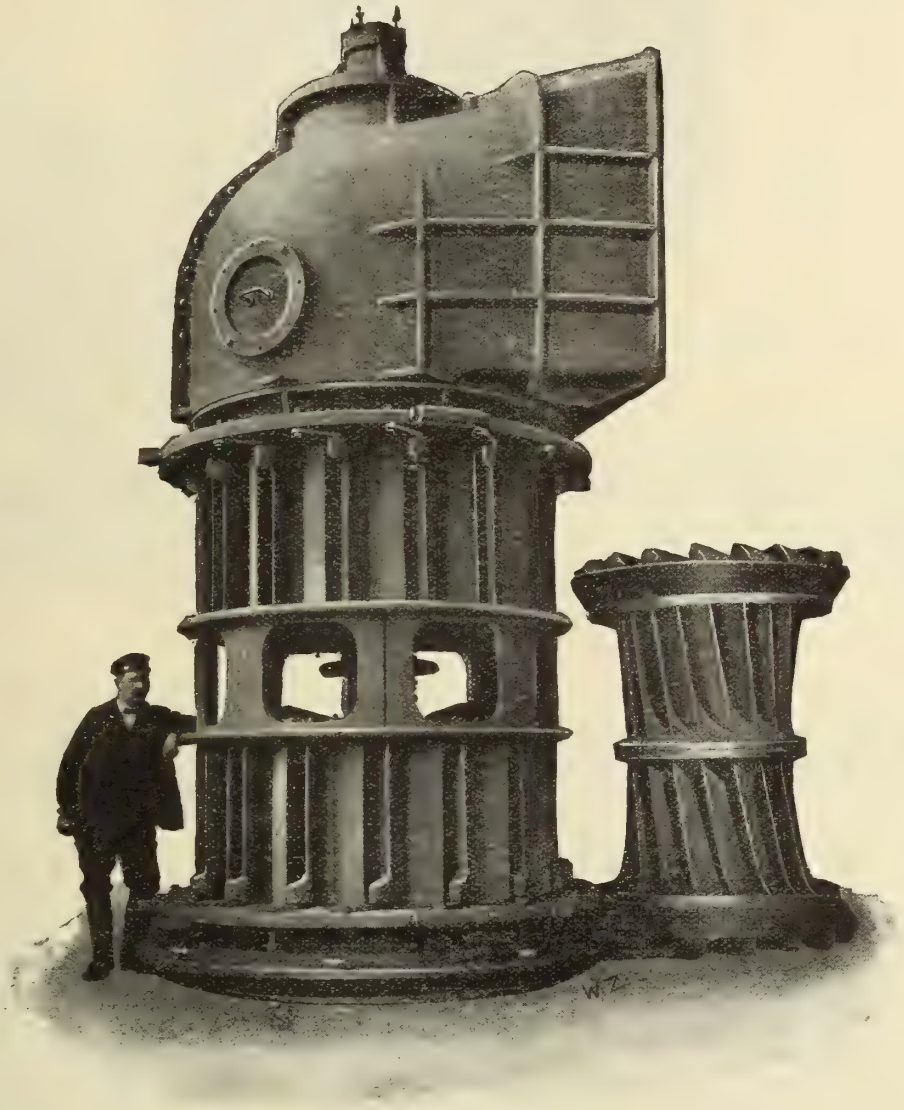
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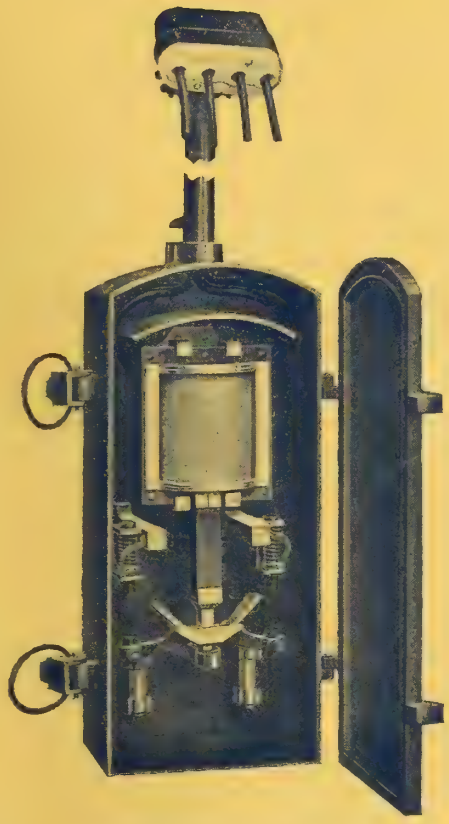
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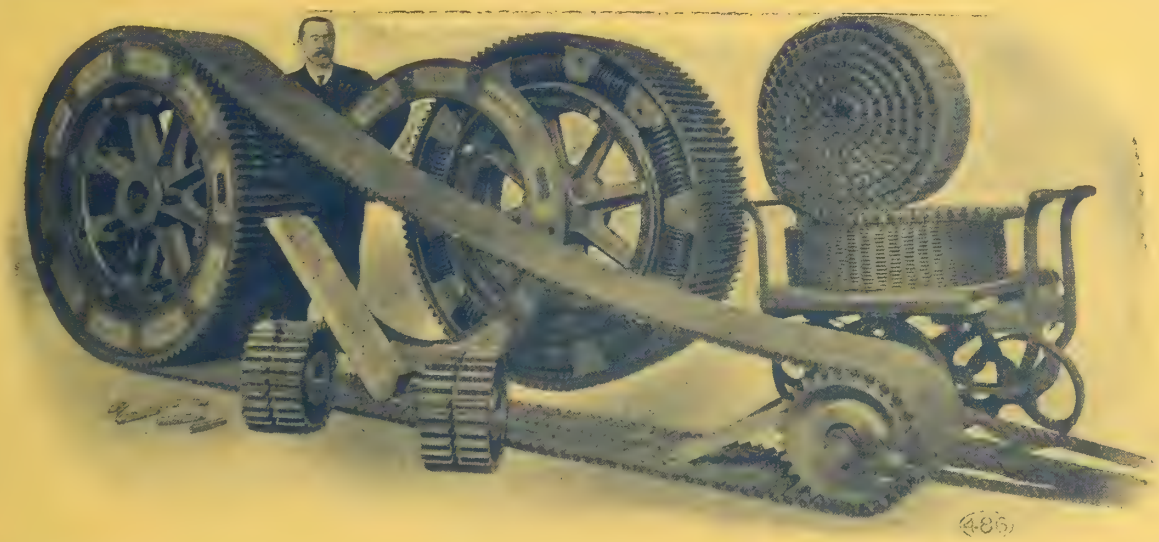
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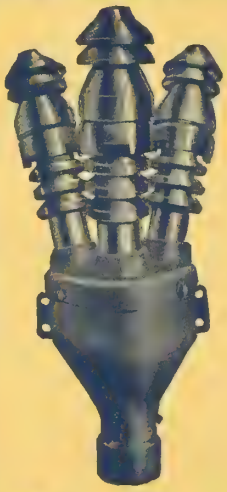
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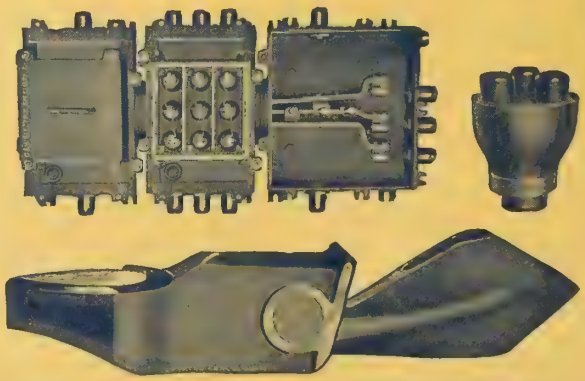
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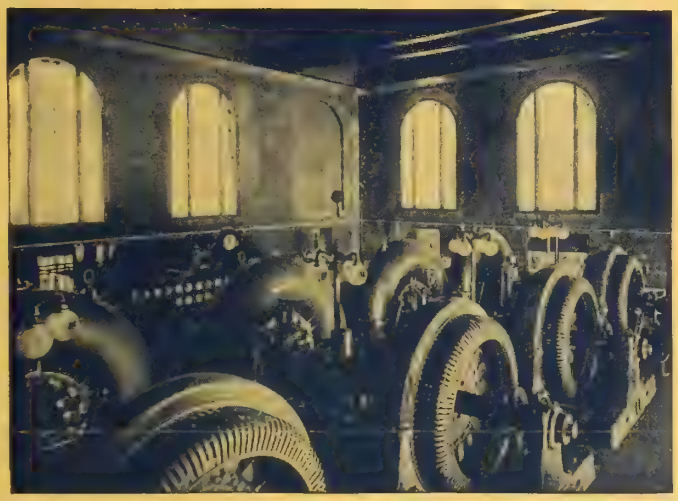


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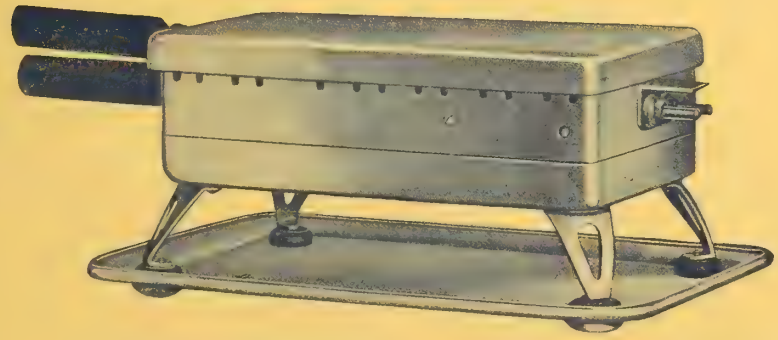
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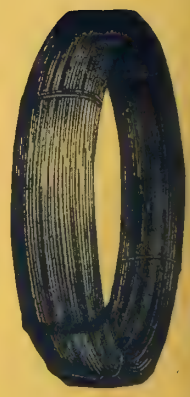
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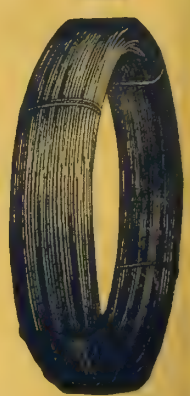
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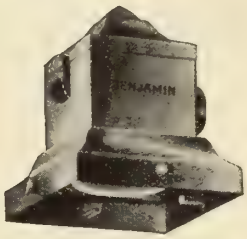
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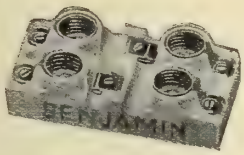
Cat. No. 59480
Key Socket



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Plug Cutout

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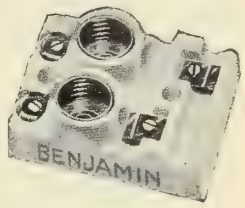
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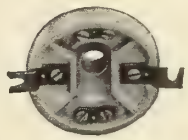


Cat. No. 61935
Plug Cutout





Cat. No. 298
Rosette





Cat. No. 870
Rosette



Cat. No. 1999
Rosette



Cat. No. 61317
Porcelain Key Socket



Cat. No. 9184
Receptacle



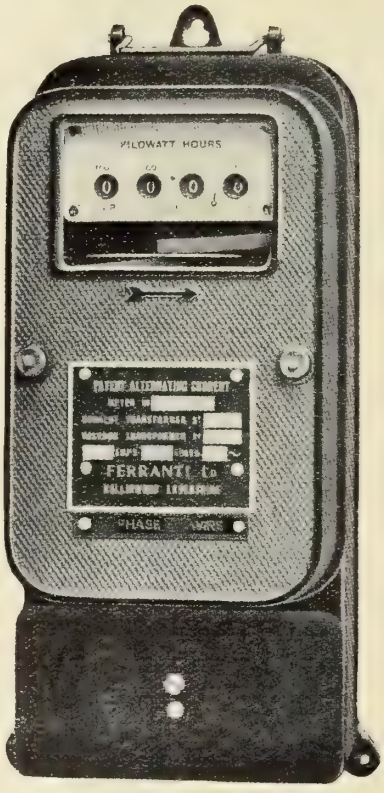
Cat. 59275
Cleat Receptacle



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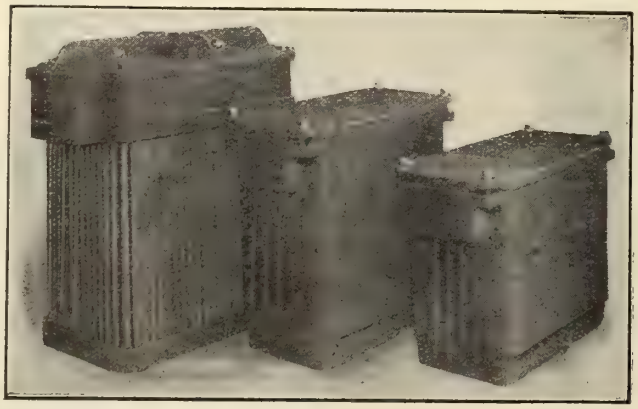
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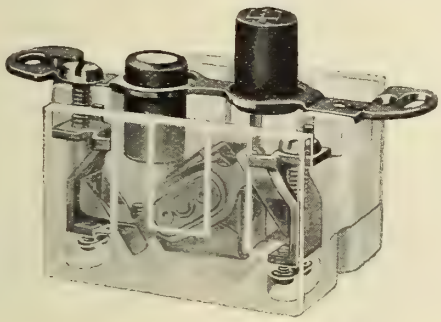
of Canada, Limited

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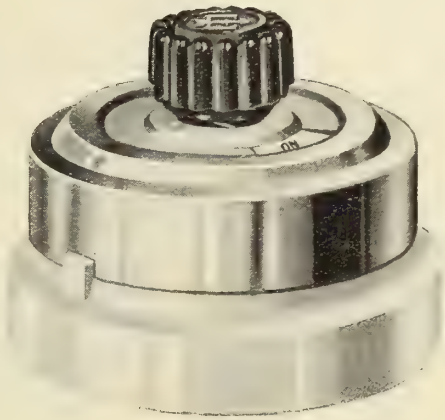
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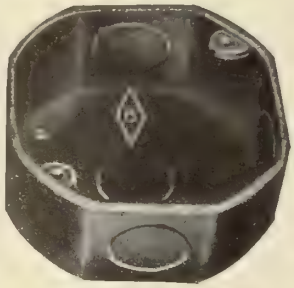
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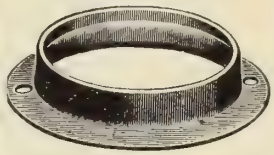
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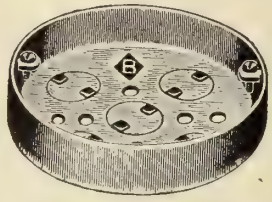
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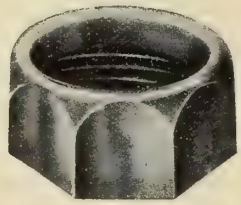
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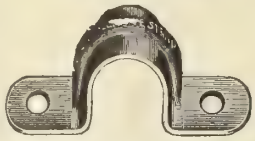
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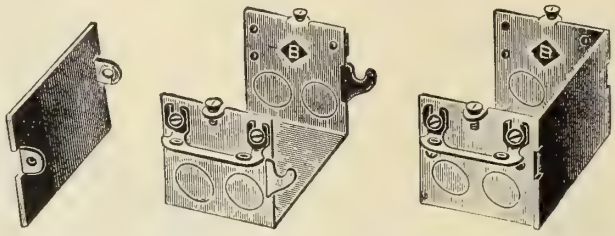


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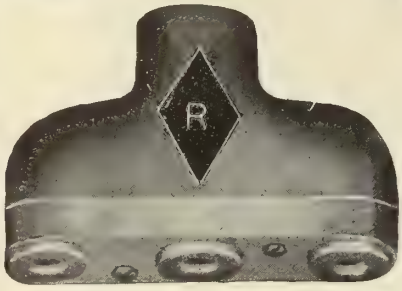


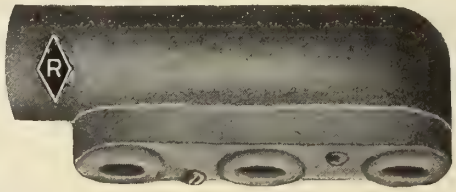


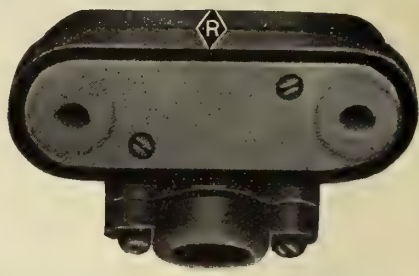
Type C 3″ deep—C C -2″ deep
side comes off and does away with carrying two gangs

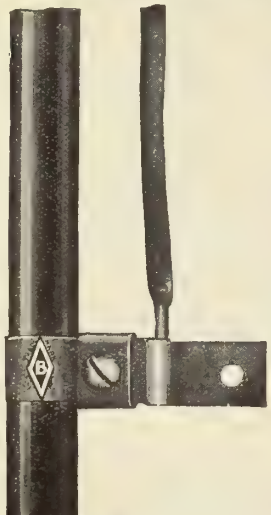


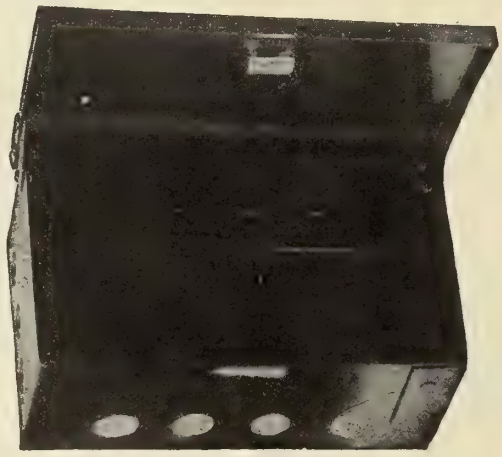
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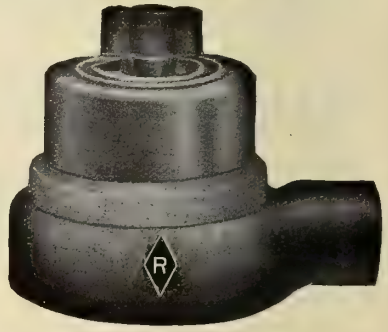


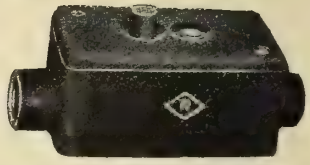


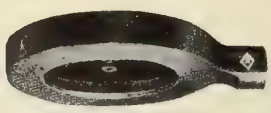




Steel Cutout Boxes

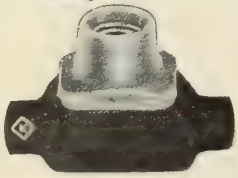


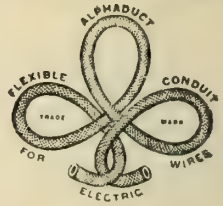




Type P







Write for Catalog No. 4



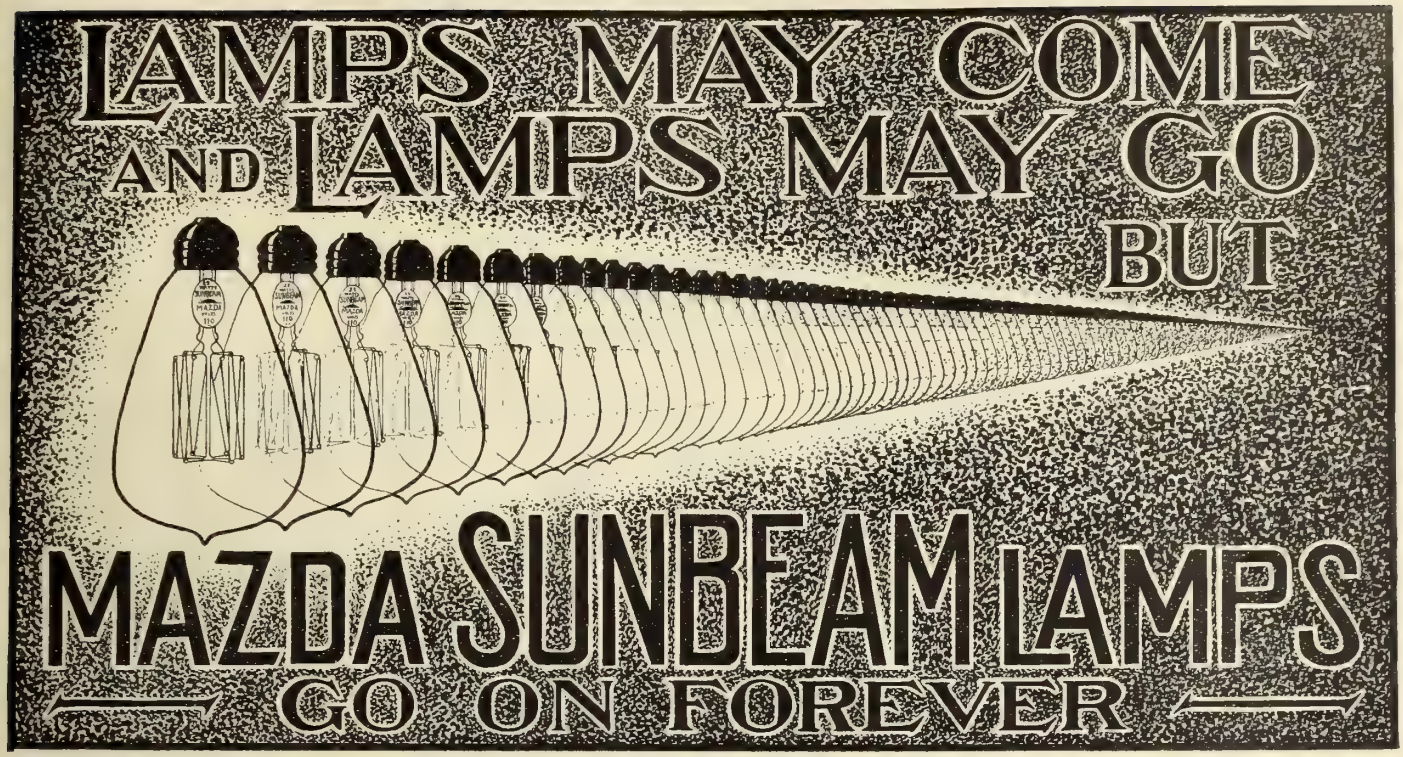
Electrical Fittings Co., Limited

331 King St. West, Toronto, Canada

Munderloh & Company, Limited
Montreal, Que.

John Starr Son & Co., Limited
Halifax, N.S.

St. John Railway Company
St. John, N.B.



IN the fight for supremacy in the field of tungsten lamps, the famous Sunbeam Mazda Lamp has always come out on top.

It is supreme because of its great efficiency, strong construction and brilliant steady light.

If your jobber cannot supply write us direct.

Canadian Sunbeam Lamp Co.

Limited

Main Office and Factory: TORONTO

BRANCH WAREHOUSES:

MONTREAL WINNIPEG CALGARY VANCOUVER

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

GALVADUCT



A "LORICATED" Building

LORICATED

Conduits Company Limited.

Toronto - Montreal

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

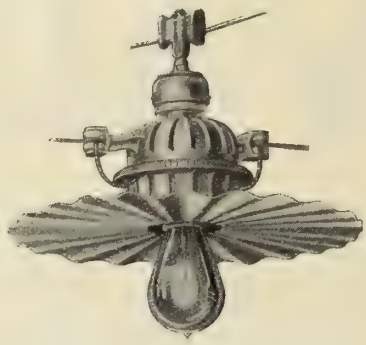
If your jobber cannot supply you—write us.

—The Midnight Sun—

In the land of the Midnight Sun, the question of efficient street-lighting is given small consideration. In this country it is one of the live questions of the day. The problem has been solved many times, but the methods then employed are now archaic. The latest and best solution is supplied in Cutter Streethoods.

Substantial Construction

High Insulation



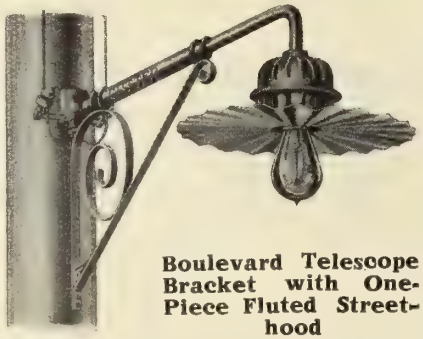
Style G—One-Piece Fluted Streethood

Easy to Install

Artistic Appearance

Cutter Streethoods

Style G shown above is a center span suspension, with the famous Cutter Cable Clamp—the choice for years of careful buyers. This artistic streethood has a reinforced porcelain insulator designed to receive series or multiple sockets. The Boulevard Telescope Bracket shown below is one of dozens of sturdy convenient brackets, fitted with one-piece fluted streethoods, comprising our big popular line. Every fluted steel reflector is fire enameled—blue on top and white on the strong reflecting surface. In service, price and appearance, Cutter Streethoods will satisfy **YOU.**



Boulevard Telescope Bracket with One-Piece Fluted Streethood

Before you make your next extension or change, write for our latest catalog, number 12. Packed from cover to cover with just the things you want to know about streethoods, arc fixtures and brackets, mast arms, ornamental posts, mazda arcs, wiring devices, etc. Hundreds of live men say our latest book is "great." YOU will too. Your copy is waiting for you here. Write—right N-O-W.

GEORGE CUTTER COMPANY

423 Notre Dame St., SOUTH BEND, INDIANA, U.S.A.

SAY TUNGSTOLIER



NOT CHANDELIER

HYDRO-ELECTRIC DISPLAY OF TUNGSTOLIERS

The Tungstolier Company of Canada Limited

212 King Street West, TORONTO

Monarch Electric Co., Ltd.

St. Lambert, P. Q.

Phone Main 3988 Montreal Exchange **District Montreal**

A few of the Monarch Canadian Made Specialties manufactured in this, our own building, are:

Sockets—Rosettes—Attachment Plugs
Lamp Guards—Knife Switches



Oil Circuit Breakers
Switchboard Accessories
Switchboards
Transformers for Instruments

The Trolley Company Will Co-operate

in your plan to give your town an up-to-date lighting system, and will let you use their trolley poles to secure a "WHITE WAY."

ERECO COMBINATION RAILWAY AND LIGHTING POLES

It is possible to utilize an ordinary street railway pole in connection with ornamental bases and brackets to support the new inverted luminous arc lamp.

You can string your wires along the top of the poles, where they are practically unnoticeable and out of the way of traffic.

You save the cost of additional lamp standards and underground construction, and avoid further obstruction of the curb line.

Catalog "D" describes this money-saving ERECO Plan—write for a copy.

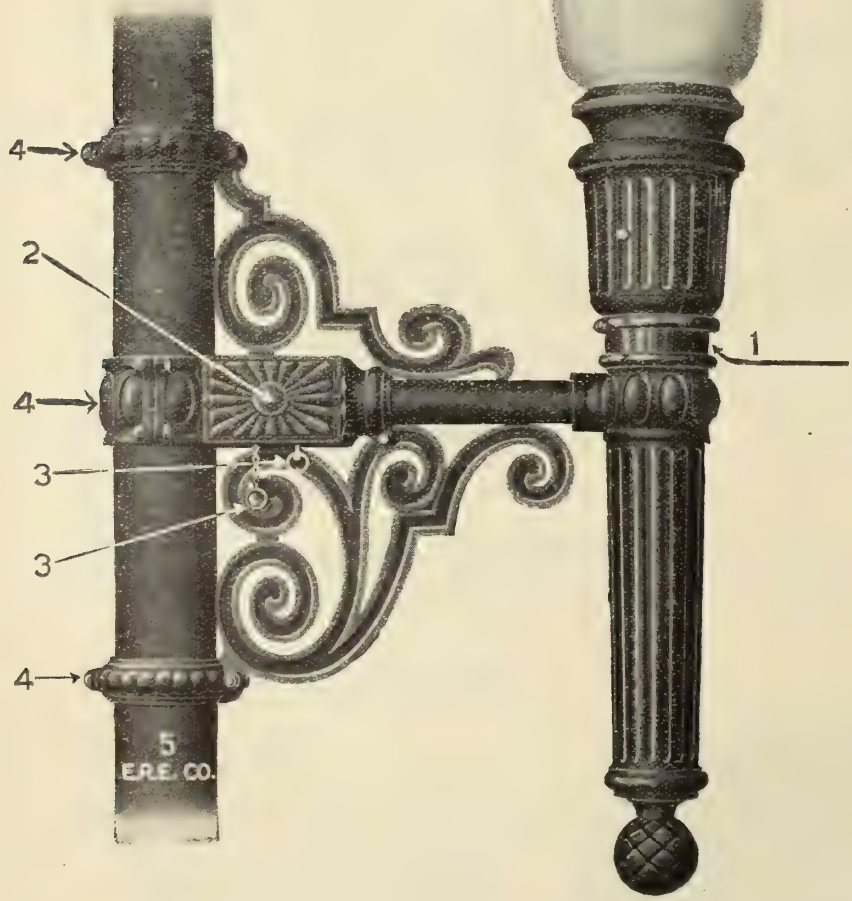
No. 1—Porcelain insulator and all parts of lamp above this point, furnished by General Electric Co.

No. 2—Removable cover plate which allows positive cutout to be mounted in bracket.

No. 3—Rings at end of chain for operating positive cutout. Cutout operated from street level by using small rod having hooked end.

No. 4—Clamp collars are made in two parts and can be furnished to fit any size street railway pole.

No. 5—Street railway pole.



Bracket Design No. 10154



Design No. 10154A

Railway pole equipped with ornamental base and bracket for supporting ornamental luminous arc lamps.

Standard pole 30 ft. over all; 24 ft. above ground line and 6 ft. below ground line. Size of pole 7 in., 6 in. and 5 in.; 18 in. swedged joints. Brackets and bases, however, can be furnished to fit any size railway pole.

We have recently furnished the following cities with lighting equipment: Regina, Moose Jaw, Winnipeg, Calgary, Edmonton, Ft. William, Nelson, Brandon.

ELECTRIC RAILWAY EQUIPMENT COMPANY

Designers **CINCINNATI, OHIO** ***Manufacturers***

NEW YORK OFFICE—30 Church St.

CANADIAN REPRESENTATIVES:
Dawson & Co., 56 Albert St., Winnipeg, Man., and 148 McGill St., Montreal, Que.



The Curtis Portable

The first ornamental lamp which also gives useful indirect light

Think seriously how profitable the Curtis Portable can be made to you. This wonderful lamp besides being a rarely beautiful ornament in the finest homes illuminates the entire room with a charming indirect light, while still retaining a ***very softly*** lighted silk shade.

It is further development of the EYE COMFORT LIGHTING SYSTEM

Concealed within the shade is the mechanical part of the lamp (called the "Adapter"), pictured and described below. The conical opaque X-RAY EYE COMFORT reflector, pointed upward, throws the light of a powerful Mazda lamp against the ceiling, whence it is diffused throughout the room, filling it with a gentle radiance.

It has been on the market but a year. Its success has been so great that we know you will be able to sell it profitably, especially to the many thousands of holiday gift-givers who will jump at the chance to make their friends a present which is so novel and so different that it will delight instantly.

The mechanical part of the lamp is sold separately

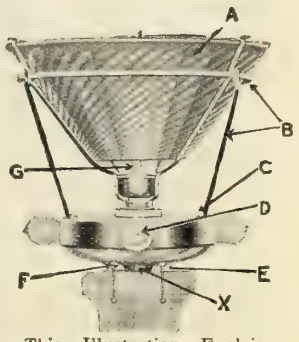
We know you will not realize the truly remarkable lighting the Curtis Portable gives from a mere reading of this advertisement. We know that the prospective customers you approach by mail-circularizing or even personal solicitation will not appreciate it. We know that to sell the Curtis Portable it must be demonstrated, and we have also found out from our experience in selling this lamp that to make a **demonstration means a sale** nine times out of ten.

You need not order the complete lamp for a sample. We will ship you the "Adapter" separately. Mount this on any floor or table lamp pedestal high enough to keep the top of the large reflector "A" just above the level of the eye. Equip it with a suitable silk shade which you can obtain locally. This will make an inexpensive demonstrating lamp.

You, too, can sell this "Adapter" separately and your customers can use it on lamp pedestals they already have.

You know the people in your locality who always seek the newest. You know where to reach them. Presented by you direct to them as a novelty, will stamp you as a man thoroughly up-to-date on artistic lighting. We will gladly furnish you the campaign ammunition.

There is a good profit-margin in Curtis Portables. They sell readily. You can order them of your jobber. Allow us to send you a descriptive booklet while there is still ample time to prepare for some substantial holiday business.



This Illustration Explains the Curtis Portable Lamp

Pulling switch **F** lights the large Mazda Lamp **G** within the X-Ray Reflector **A**. The holder **B** keeps the reflector exactly in the proper position. A little light strikes the surface **C**, illuminating the shade. This completes the resemblance to the ordinary art lamp. The flood of light, reflected to the ceiling, is diffused to every corner of the room, making reading a pleasure and any social amusement a comfort. The Curtis Portable Adapter may be placed on any floor lamp pedestal and on many table lamp pedestals at small expense. Write for particulars.

National X-Ray Reflector Company

General Offices
225 W. Jackson Boulevard
Chicago

New York Office
Eye Comfort Lighting Shop
14 W. 33rd Street

GMUR & COMPANY, LIMITED

Aarau, Switzerland

CAPITAL $ 200,000

Carbon Filaments in all Shapes and Sizes **Flexible Metal Filament "Uranit"**

Drawn Light Wire "Uranit" **Supports** Carbon, "Uranit" Alloy Molybdenum, Molybdenum Alloy

Tungsten-Molybdenum Wire in all Sizes

LARGEST SPECIAL FACTORY FOR LAMP FILAMENTS



ATTRACTIVE STREET LIGHTING

For

Series or Multiple Systems

We Have Supplied Units for

Arnprior	Georgetown	Paris
Barrie	Goderich	Port Dalhousie
Berlin	Harriston	Trenton
Brantford	London	Tweed
Brockville	Ottawa	Toronto
Chatham	Oshawa	Welland
Cornwall	Preston	and many others

Write us regarding your contemplated street lighting

A. H. Winter Joyner, Ltd.

"Consult a Specialist"

76 Bay St., Toronto

"EUREKA" ELECTRIC CLEANER

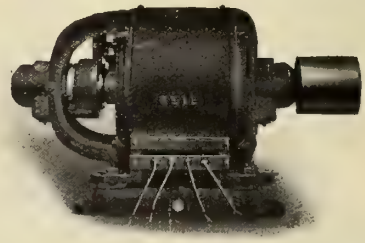


Thoroughly reliable and absolutely guaranteed. Sold at a moderate price with a good profit to the dealer.

Write for particulars and agency.

Onward Manufacturing Co., Berlin, Ont.

"BELL" High Efficiency Single Phase Motors



Meet All Requirements

Large stock carried throughout the country for immediate shipment.

Attractive Prices consistent with QUALITY

Our bulletin No. 138 which fully describes them will be sent to all interested.

Bell Electric Motor Co., 30 Church Street, NEW YORK CITY

LICENSED. Factory, GARWOOD, N. J.

Canadian Representative:

The Masco Company, Ltd., 205 Yonge St., Toronto, Can.

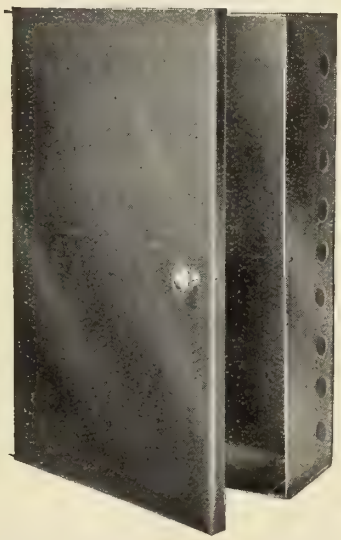
Stock carried in Canada

"LOOK" Something New

"Devoe" One Piece Form Metal Boxes

Made in Canada

Write for Bulletin No. 2



Our Box Department has increased at such a rate that we have had to enlarge our floor spacing by 10,000 square feet.

Our one piece metal boxes are built of the Best English steel and with the largest up to date Box Machinery.

We can supply you with any size Box of any Guage at the lowest price.

Write for our Sample Box 4″ x 9″ x 3″ (its free)

The Devoe Electric Switch Company

No. 157 Craig St. West - Montreal

YOU can't afford to have inefficient meters on your transmission lines.

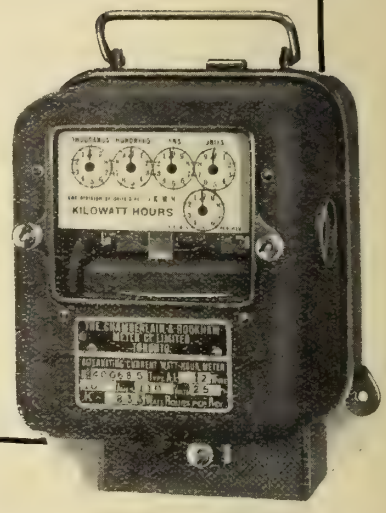
Did you ever stop to think of the many dollars that are actually wasted each year through the lax meter equipment of some systems?—dollars that could by the installation of reliable meters be turned into revenue?—and did you ever stop to wonder if **your** system is suffering from the same cause? It may be—at any rate it would pay you to make a thorough investigation.

C & H METERS

have, in the past, given such consistent satisfaction to their many users that we, as manufacturers, feel confident that they will do for you what they have done for others.

In design and construction C & H METERS represent the finished efforts of some of the most prominent meter engineers. Infinite care is taken to insure, as near as possible, a perfection of accuracy that can at all times be relied upon—a rigid and actual working test being made on each instrument before it is shipped.

A large stock of single and polyphase together with two-rate types is carried at our Toronto warerooms. Try us for a rush order.



Chamberlain & Hookham Meter Co., Ltd.

TORONTO 120 Richmond St. W. ONTARIO

Spencer & Aspinall 617 New Birks Bldg., Montreal, P.Q.

Use

Pass & Seymour

Time, Labor and Material Saving Devices On Your Next Installation

Pass & Seymour, Inc., have made a specialty of cost reducing fittings. Send a trial order and be convinced.

Send for Catalogue No. 20 It is full of trouble saving "kinks"

P&S ELECTRICAL SPECIALTIES

All devices guaranteed to be up to representation.

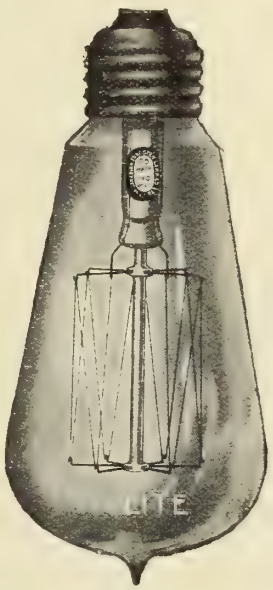
Mainer Electric Company, Limited

WINNIPEG, MAN. **EDMONTON**

Prompt Shipments ***New Goods*** ***Right Prices***

NULITE

HERE IT IS



Genuine Drawn Wire

Continuous Filament

TUNGSTEN LAMP

We Reduced the Price but The Quality Remains the Same

The price of "Nulite" Tungsten lamps has been periodically reduced in the past, but the "unexcelled" quality of material and workmanship is gradually mounting higher and higher.

We have an excellent proposition to offer all dealers, which includes a series of advertising circulars and ideas.

Now is the time to lay in your supply.

THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.

AGENCIES: T. McAvity & Son, St. John, N.B.; Farquhar Bros. Ltd, Halifax, N.S.; Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto, Ont.

Is Every $ Working?

To Central Station Managers:

IS every dollar invested in your electric light and power producing revenue? We refer particularly to the good money that is hourly escaping from your exhaust pipe. Hundreds of Electric Light and Power plants are paying coal and labor bills by the sale of their Exhaust Steam for heating purposes.

If interested, write us and we will prepare a prospectus to prove conclusively that your Exhaust Steam can be made a money-maker for you.

Our Booklet "Central Station Heating" will interest you.

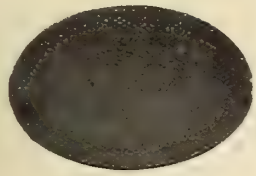
American District Steam Company

General Offices and Works:

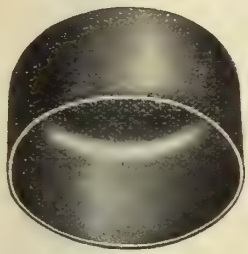
North Tonawanda, N.Y.

Chicago, Ill.
First National Bank Bldg.

Seattle, Wash.
Hoge Bldg.



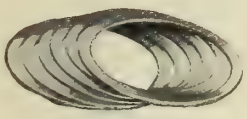
Punched Disc.



Cupped and Trimmed.



Blank Punched Out of Bottom.



Spacing Rings.



Assembled Field Punchings for A. C. Motors.

Drawn Shell Construction for Small Alternating and Direct Current Motors

The illustrations show the principal steps in the construction of the Canadian General Electric Co.'s "Drawn Shell" motor.

To all who possess a quick discernment for real values in goods electrical, "Drawn Shell" construction has many interesting features which become readily apparent from a close inspection of the product.

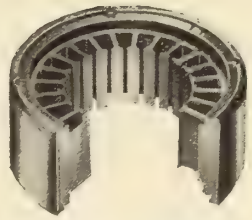
Uniformity of excellence in the material used for Drawn Shell motors is obtained through purchase in large quantities under rigid specifications. As the combined result of unequalled tool equipment, scientific manufacturing processes, the employment of expert workmen, and final testing under the supervision of the Designing Engineers, a practically flawless finished product is assured.

The satisfactory, continuous operation at brake horse-power rating of all Drawn Shell motors, with ample margin for reasonable overloads without sparking or overheating, is made certain by a careful, initial design and those niceties in mechanical and electrical construction, characteristic of all material bearing the trade mark "C. G. E."

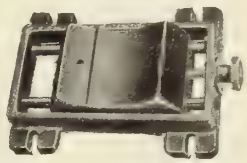
Drawn Shell motors are used to drive small machine tools, pumps, compressors, vacuum cleaners, sewing and washing machines, etc., etc.—these sturdy little motors meet an infinity of power purposes for shop, factory, store, office or home.

Sizes 1/50 to ¾ H.P.—with open or totally enclosed frames.

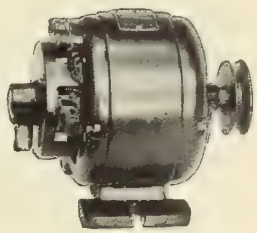
Bulletin No. 4963, giving a complete description of Drawn Shell motors, will be gladly sent on request to our nearest office.



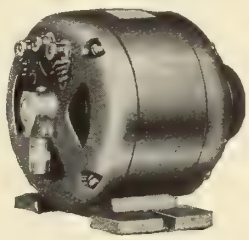
Rings and Punchings Clamped by Turned Over Edges of Cup.



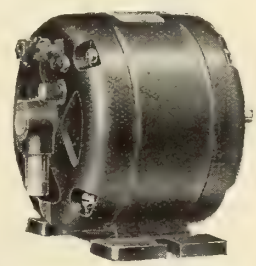
Sliding or Plain Removable Base Furnished as Desired.



Type D. S. D. Direct Current Motor.



Type D.S.S. Single-phase Alternating Current Motor.



Type D. S. T. Three-phase Alternating Current Motor.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

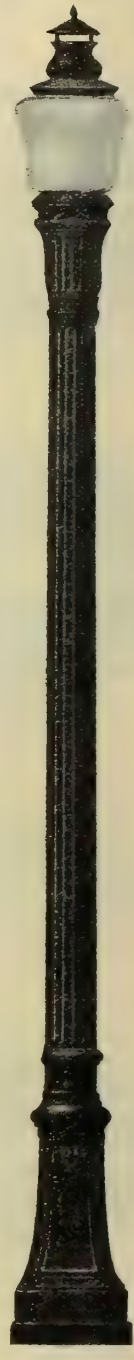
Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert.

Ornamental - Luminous - Arc - Lamp -



The Lamp That Stimulates Business



Wherever this new Ornamental Street Lamp has been installed merchants are unanimous in their praise of it, because this handsome "white way" has considerably increased business.

Civic pride is aroused, citizens are taking more interest, are showing a greater enthusiasm and are more loyal towards their city than ever before.

This not only means increased trade to the merchants from residents but also from surrounding cities.

The New Ornamental Luminous Arc Lamp gives a brilliant, soft, white light, and by day the artistic poles add a charm and attractiveness to the thoroughfare.

A bulletin "de luxe" showing many installations and describing this new system of Ornamental Street Lighting will be mailed on request.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
Cobalt Regina Edmonton Porcupine Saskatoon Nelson Prince Rupert

C.G.E. Ornamental Luminous Arc Lamps

Make the "City Beautiful"

One of the first aids towards bettering conditions in a city and making it attractive is good light on the streets.

The C. G. E. Ornamental Luminous Arc Lamp does both. The brilliant, soft, white light from the lamps besides illuminating the sidewalks and streets, lights up the adjacent buildings, so that the architectural details are brought out and locations of business are not wholly lost when evening falls.



General effect of Luminous Arcs on Eighth Ave., Calgary



Front lighted by Magnetite Arcs—Side lighted by Tungsten Clusters

Further, the appearance of the streets by day is made attractive by these handsome and artistic lighting units.

This lamp is giving the utmost satisfaction wherever an installation has been made.

Our nearest district office will gladly furnish on request descriptive bulletin No. 4955 and full particulars.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

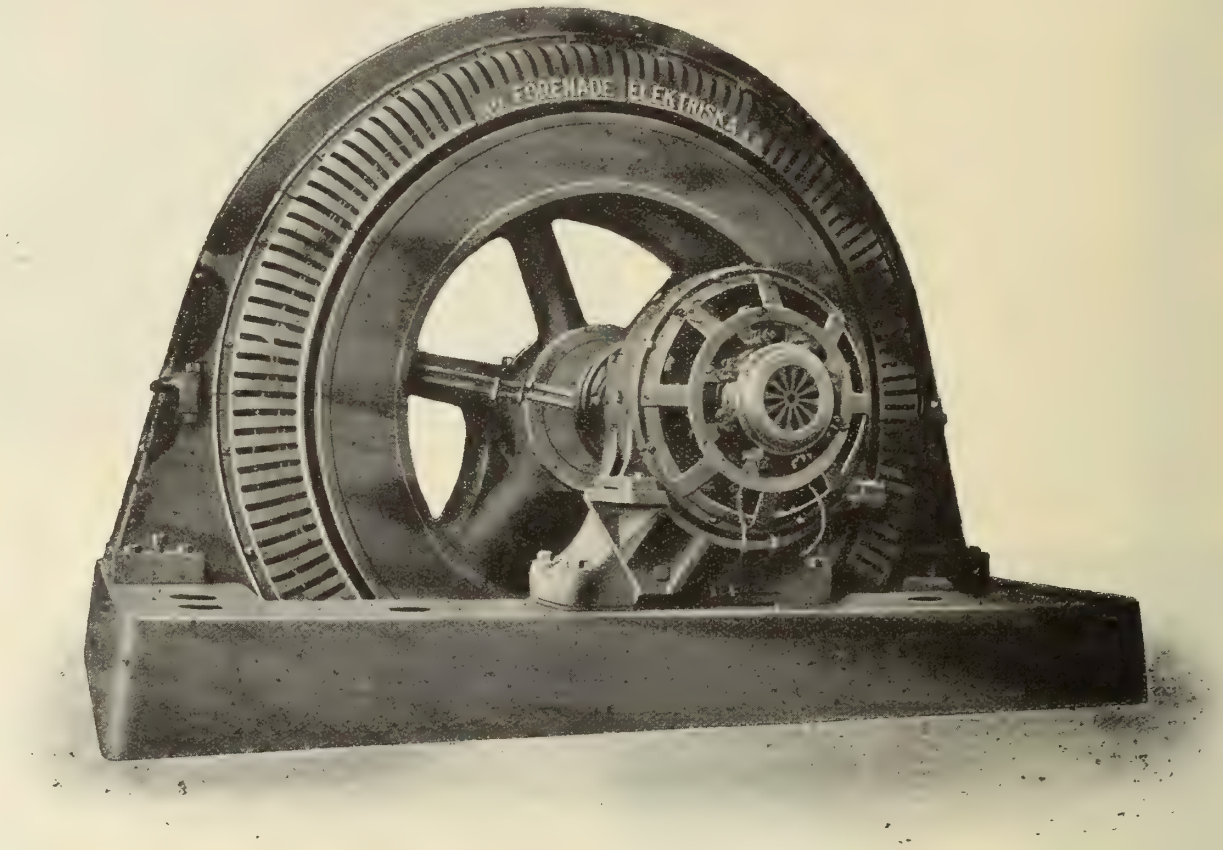
Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

Swedish Electrical Machinery

Noted for

Efficiency and Workmanship



1800 K. V. A., 2200 Volt, 60 cycle, 3 phase 257 R. P. M. fly wheel type generator for direct connection to water wheel.

We solicit your specifications for Electrical Equipment

BURNHAM ENGINEERING COMPANY

LIMITED

Canadian Dealers for

The Amalgamated Electric Company of Sweden

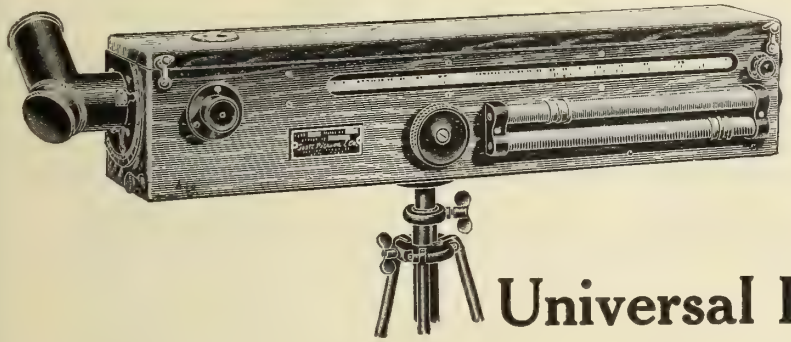
Head Office:
Traders Bank Building,
TORONTO

Montreal Representatives:
Rudel Belnap Machinery Co., Ltd.
Canadian Express Bldg.

G. M. Gest

Conduit
Engineer & Contractor

503 Power Building, Montreal, Can.



Convincing the Consumer

by means of the

Sharp-Millar
Universal Portable Photometer

Everyone conducting service along the lines of business-like science—in keeping with other progressive sciences—cannot be without the **Sharp-Millar Universal Portable Photometer.**

This instrument is a matter-of-fact accessory for measuring light. It comes into play at the outset as a means for accurately determining just what defects exist in an installation and, finally, enables the expert to check up the installation he prescribes, thus establishing a definite basis for "proving his case."

The **Integrating Sphere** in conjunction with the **Portable Photometer** is of indispensable use for those desiring to test efficiencies claimed for incandescent electric lamps,—measures mean spherical candle power, horizontal intensity or candle-power in any direction. *Write for Bulletin*

FOOTE, PIERSON & CO.

162 Duane Street *Sole Licensees and Manufacturers* **NEW YORK**

A SILCOR TUMBLE

Beats The Balls Buffer, Sand Blast

And all other devices for polishing

THE HIGHEST AND CHEAPEST LUSTRE AND IN EVERY TINY CORNER

TENDER WITH THE MOST DELICATE BUT CUTS THE HARDEST STEEL BRASS, NICKEL, CAST IRON, GERMAN SILVER, STEEL—ANY METAL

Small Plants—Five dollars' worth of "SILCOR" and an improvised barrel will save most all that hand labor.
Large Plants—Dispense with hand labor and roll both tiny and huge pieces in "SILCOR."
Holding a piece to a buffer is as illogical as turning the buffer by hand. Let the Power roll it in "SILCOR." "SILCOR" will find every spot.
It costs so little to polish by tumbling with "SILCOR" that no piece ought to leave your plant unpolished.
Send 10c and parcel postage for sample pound and shake some of your pieces in a tin can. Then send for a barrel load.

Corundum Products Company

Spokane, Washington, U. S. A.

Walpole Rubber Co., Limited

Factory at Granby, Que.

Sales Office No. 8 McGill College Avenue, Montreal, Que.

Our parent Company in Walpole, Mass., U.S.A., has been manufacturing for a great many years, Splicing Compounds, Friction Tapes, and other Insulating Compounds, and we have a factory at Granby, Que., where the same class of goods are made, under the same general supervision.

Your inquiries with reference to Friction Tapes, Splicing and other Compounds are requested; we can assure you of the quality, and prices will be as low as possible, taking quality into consideration.

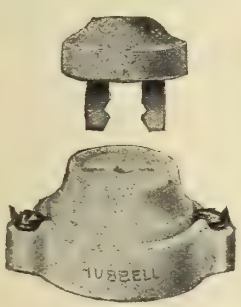
We would draw your special attention to our No. 400 Splicing Compound, a very high grade Rubber Splice, which will at least equal any on the market, and we claim surpass.

Correspondence Invited

There is Good Earnest Money for the Dealer Who Sells Hubbell Attachment Plugs

The contractor profits by installing them in residences, hotels, hospitals and business buildings.
Central Stations benefit by increased consumption of current that follows sales of devices fitted with Hubbell Plugs.
The demand for Hubbell Interchangeable Plugs never ceases—constantly increases because they cost no more and do much more than common one-piece screw-in plugs.
Put them on your electric fans, lamps, and all other portable devices. They will help to sell your goods and always satisfy your customers.
Ask for a sample Plug and a supply of the new Hubbell advertising literature.

R. E. T. PRINGLE No. 95 King St. E., TORONTO



Cleat Base
No. 5512



Moulding Base
No. 5540

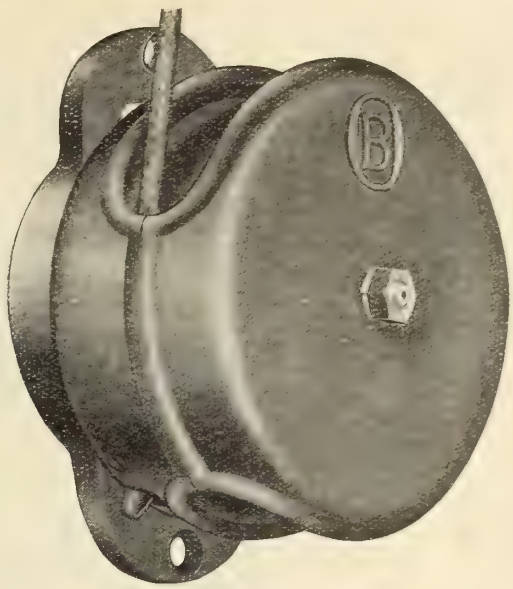
THE
MANHATTAN
Electrical Supply Co.

Manufacturers of
Telegraph and Telephone Instruments and Supplies
Wireless Outfits
Fire and Burglar Alarm Apparatus
Annunciators—Letter Boxes—Speaking Tubes
Electric Heating and Cooking Apparatus
Electric Bells—Push Buttons
Testing Instruments
Ignition Apparatus
Automobile and Motor Boat Supplies
Medical Batteries—Massag Vibrators
Electric Toys and
The Red Seal Dry Battery

"Something Electrical for Everybody."

For catalogues and full information address

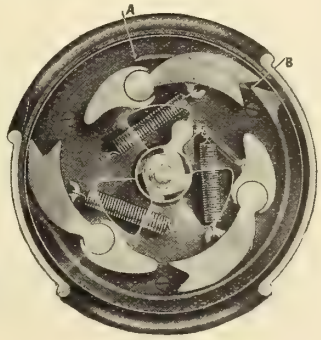
FRANK G. SCOFIELD
REPRESENTATIVE FOR ONTARIO
702 LUMSDEN BLDG. - TORONTO, ONT.



O-B Trolley Catcher

Has quick and positive action. When trolley pole jumps, it is caught quickly and held when caught. There is no "stepping up" or "climbing" after the rebound.

Phantom view shows principal operating parts. Three dogs are thrown out by centrifugal force when trolley jumps. Guide (A-B) prevents dog engaged with stop at (B) from releasing on rebound.



We will gladly make a service demonstration on your line.

The Ohio Brass Co.
Mansfield, Ohio, U.S.A.

Consider those two most important factors "SERVICE" and "MAINTENANCE"

when you are purchasing telephones. Realize that the financial success of your plant is dependent upon your ability to please your subscribers by making your service speedy and reliable and in cutting down every dollar of expense possible.

Put your money into Kellogg telephones and make a safe investment. There will be a big demand for your service. Every dollar spent will bring you, in return, service of the highest order. Service that has made thousand line exchanges from a small beginning of a few hundred lines.

There are ten thousand or more complete Kellogg plants in the United States which stand as evidence of this fact. Give us a trial order. Give us an opportunity to demonstrate the superior talking quality of our telephones.

Send for our bulletins which, aside from description of apparatus, contain valuable information on modern telephone practice. Kindly mention this magazine when writing.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

CHICAGO, ILL.

CANADIAN SALES OFFICES:

REGINA—DEERING ELECTRIC LIMITED, **WINNIPEG—HOUSTON & COMPANY, LIMITED**

For unerring accuracy—



Metal Case Type "K"

PACKARD METERS

Acknowledged by leading electrical engineers to be the standard for use on all power and light circuits.

The many improvements which we have recently made in "Packard" meters, without a doubt make them the most accurate and reliable meter on the market.

Don't take chances with your revenue and with the service to your customers by installing an inferior meter. Get the best—the **"PACKARD."**

Single and Polyphase types in metal or glass cases for circuits of all descriptions.

Large Stock Carried at:

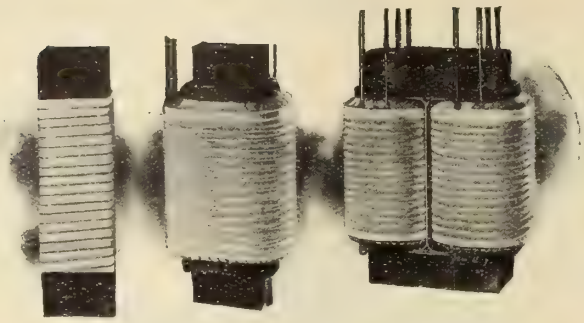
St. Catharines and Winnipeg St. John Railway Co., St. John, N. B. General Supplies, Limited, Calgary, Alta. Rudel-Belnap Machinery Co., Canadian Express Bldg., Montreal, P. Q.

The Packard Electric Company, Limited

Factory at ST. CATHARINES, ONT.

General Sales Office
Traders Bank Bldg., TORONTO

N. W. Office and Warerooms
WINNIPEG



The

Moloney Transformer

A Model of

Simplicity

and

Efficiency

Canadian Moloney Electric

WINDSOR, ONT. Company, Limited

Factories at Windsor, Ont. and St. Louis, Mo., U. S. A.

825 Vancouver Block, Vancouver B. C., Canada 901 New Electric Railway Chambers, Winnipeg, Man., Canada
501 C. P. R. Building, Toronto, Ont., Canada

Complete stocks carried at Windsor, Winnipeg and Vancouver

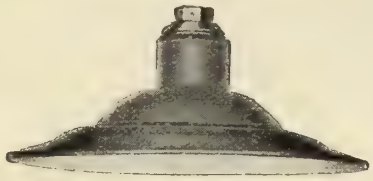




No. B A D 500
with holder and Mogul Socket No. 622



D E D 100



R E M M 60



R E L 500

HOLOPHANE-D'OLIER Metal Reflectors

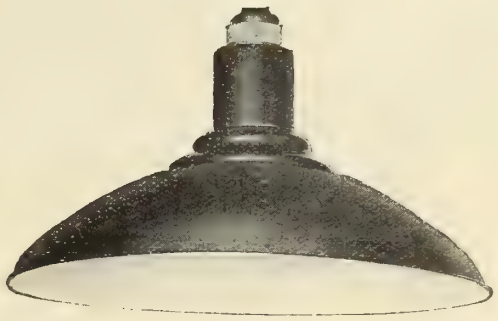
Cleanezy-Aluminum and Porcelain-Enamel Finishes

The Line that Establishes the Standard for Factory Lighting



Solid extension R Type Holder
Easy to wire attachment

Have You Received Our New Metal Reflector Catalogue?



R E D 500

The new Cleanezy-Aluminum Finish—reaches the highest point in metal reflector perfection.

"Hard to Soil, Easy to Clean"

Made for every size of Mazda Lamp—six distinct holders—all angles and distributions—they solve every factory-lighting problem.



A E 250

The

Holophane Company

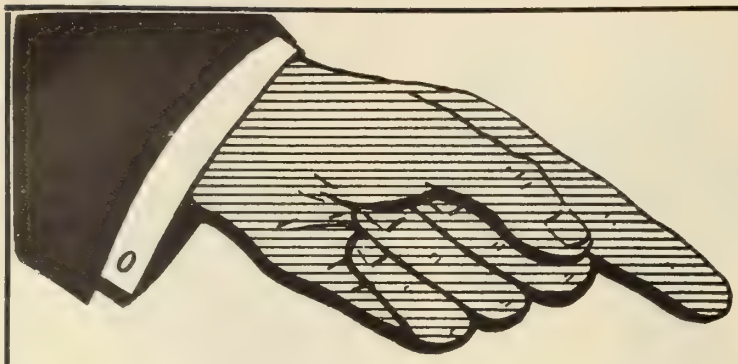
Limited

Toronto, Canada

Holophane Glass a Toronto Product



A I 250



SEE

Canada's First ELECTRICAL EXPOSITION

WITH the active support and co-operation of the Montreal Light, Heat and Power Company, a thoroughly representative showing by the manufacturers, dealers and jobbers of electrical supplies and appliances for the purpose of demonstrating to the public all modern uses of electricity in the home, factory and office and in medicine and surgery, together with many other departments.

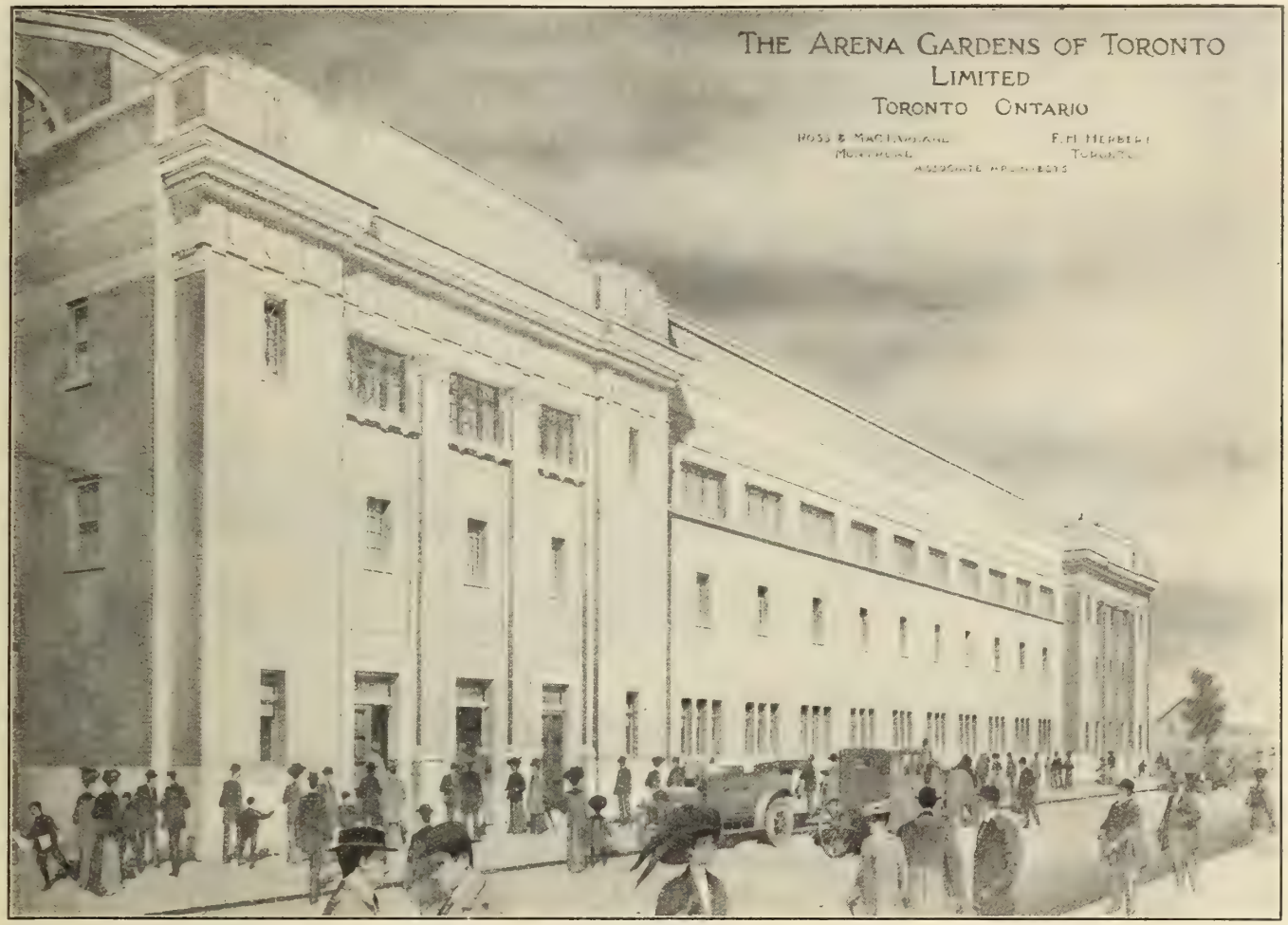
To be held at

Montreal Arena

Nov. 1st to 8th

Address inquiries,

Manager's Office, 910 New Birks Bldg., Montreal



A NEED, long felt by the Ontario electrical trade, will be filled by the Toronto Electrical Show to be held in the Arena Gardens, Toronto, from November 10th to the 15th.

The Organization of the Exhibition is well advanced. Hearty support of the idea has been received on all sides and the exhibition is assured of being a most creditable affair, in which there will be a thorough representation of the trade.

The purpose of the exhibition is to give the exhibitors a means of advertising and selling to the public, including central station men and the entire electrical trade of Toronto and the Province of Ontario.

The show will be very extensively advertised and the management will provide a number of special attractions of an electrical nature, together with special decorating in keeping with the character of the exhibition.

To be held at

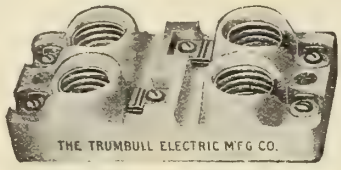
Toronto Arena

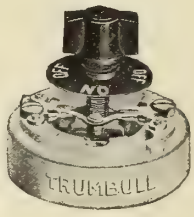
Nov. 10th to 15th

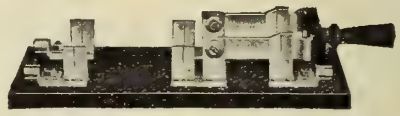
Address inquiries,

Manager's Office, 62 Temperance St., Toronto





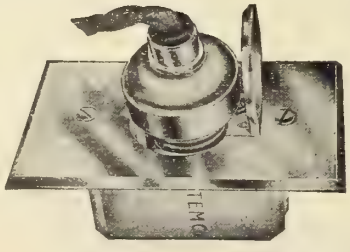


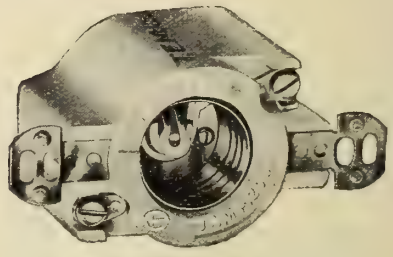


WE SHIP

from

STOCK





CANADIAN BRITISH ENGINEERING COMPANY, LIMITED

324 Smith Street, WINNIPEG Telephone M 2410 2411



Sell Them by the Box

Educate your lamp customers to ***buy them by the box.*** An argument that should appeal is the convenience it affords in being able to carry home as many as five lamps in one neat carton, also that by so doing they may always have a few on hand in case of emergency.

Selling them by the box means that you sell five lamps instead of one or two. Think of the increase this makes in your lamp sales.

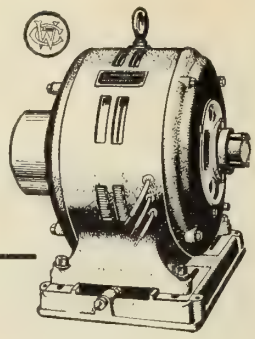
Fill up your window with these Northern Light cartons. Their attractive design compels attention.

Look for the name— *Northern Light* etched on each lamp—

THE *Northern Electric*
AND MANUFACTURING CO. LIMITED

Montreal	**Halifax**	**Toronto**	**Winnipeg**
Regina	**Calgary**	**Edmonton**	**Vancouver**

We have a special line of ball-bearing motors designed to eliminate troubles due to seizing through dust and grit or through lack of oil, freezing in cold weather etc.



These motors have the smallest possible air gap and highest possible efficiency. Large stock of motors of all sizes for 25 cycle current carried in Toronto, ready for immediate shipment Over 50,000 H. P. in satisfactory operation, from Coast to Coast.

Standard Protected Type Squirrel Cage Induction Motor

Direct Current Motors

We also handle alternating current elevator motors, variable speed motors for driving printing presses, refrigerating machinery, etc. also small single phase motors with high starting torque.

Enquiries solicited for all classes of Electrical Machinery and apparatus.

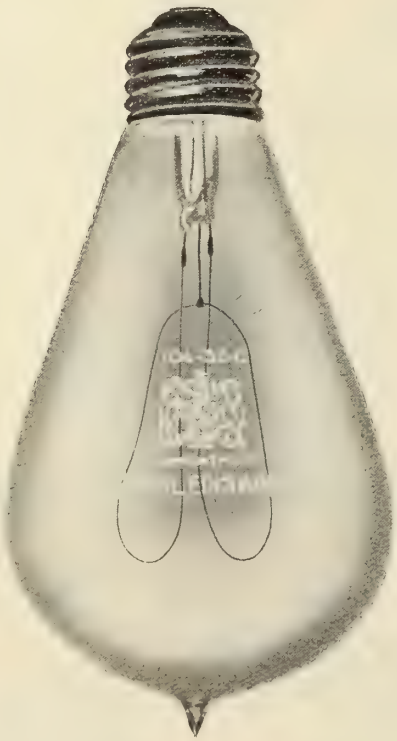
Single and Polyphase

Manufactured from the best and most dependable material by the highest grade of English workmanship.

We can Supply any special design of motor that is particularly adapted to any class of work.

CHAPMAN & WALKER LIMITED

TORONTO - CANADA



No. 21 Bulb, 50 C. P.

We are sole Canadian agents for

"ROYAL EDISWAN"

CARBON FILAMENT LAMPS

In the manufacture of the "Royal Ediswan" Carbon Lamp, the makers have spared no effort to perfect a product of superior quality and maximum efficiency.

Those among your customers who prefer the carbon filament lamp will find the "Royal Ediswan" a satisfaction which comes only from a high-grade product.

Made in standard American bulbs, (also fancy bulbs) and built to standard specifications.

We are prepared to make prompt shipments on all orders—large or small.

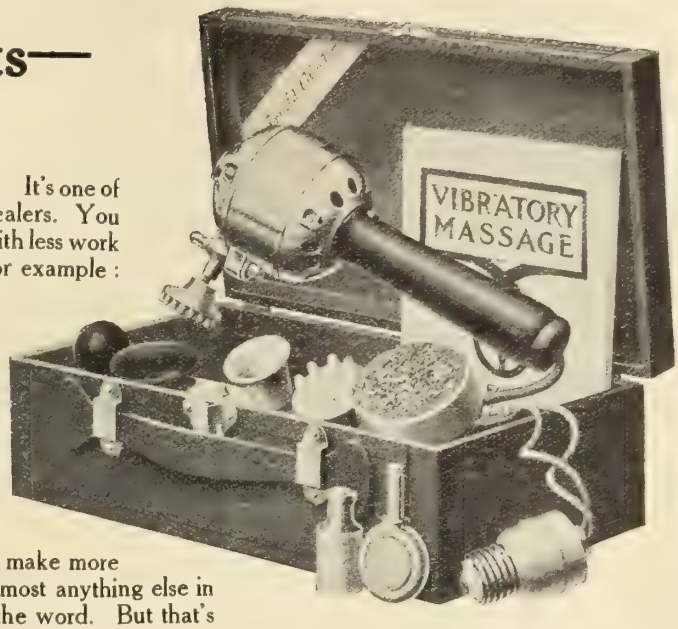
Chapman & Walker, Limited

TORONTO 118-20 Richmond St. W., ONTARIO

MONTREAL WINNIPEG VANCOUVER

Quick Sales—Big Profits—
Lots of New Customers—

There's the Arnold Vibrator proposition in a nut-shell. It's one of the most attractive things in the market to-day for live dealers. You can make more sales and bigger profits on the Arnold with less work and less money than on anything else in the field. For example:



Your Profit on the

Arnold Massage Vibrator

is so liberal and the turn-over so quick, that you can make more actual money per dollar invested in Arnold's than on almost anything else in your stock. We'll prove this just as quick as you say the word. But that's not the only reason. You get the benefit of our

National Advertising in the big magazines—going month after month into homes everywhere—making customers for the Arnold and sending them to Arnold dealers. And, mind you—you get every sale that our advertising starts in your town for we take

No Mail Orders for the Arnold Massage Vibrator. We are positively the only manufacturers in our line who neither sell directly to consumers nor through mail order houses. Whenever an inquiry comes to us from your territory, we turn it right over to you so that you can make the sale and get the money. And to help you clinch these sales we give you

Selling Helps that bring customers right into your store. Pamphlets, leaflets, and envelope stuffers—all imprinted with your own name and address—and a variety of attractive window cards, show cards and hangers. The Arnold Massage Vibrator is a mighty satisfactory thing to sell, too, because

The Arnold Guarantee is so broad that you can feel perfectly free to tell your customer that if his Arnold isn't satisfactory in every way, you'll **give him a new one without any quibbling.** We stand back of you to see that every Arnold makes good.

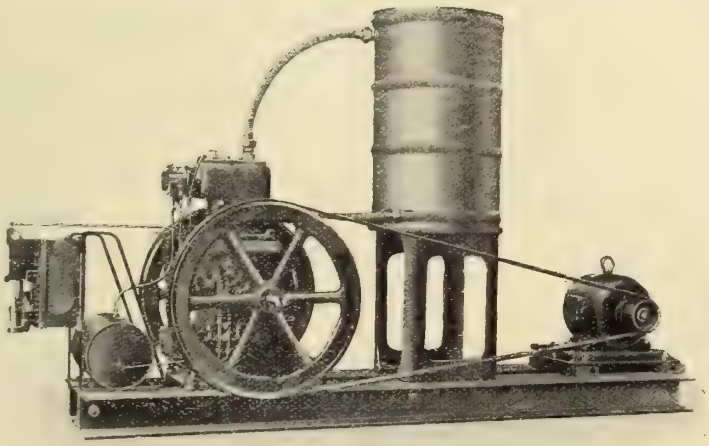
We've got a bully proposition for you. Write for it to-day.

The Standard Electric Works, - - - Racine, Wis.

The LISTER-BRUSTON
AUTOMATIC ELECTRIC LIGHTING PLANT

Are you interested in the lighting of

Country Houses
Hotels
Summer Homes
Churches
Factories
Small Towns
Villages?



This is the easiest and cheapest plant to install and wins you the confidence of your customer.

Agents Wanted

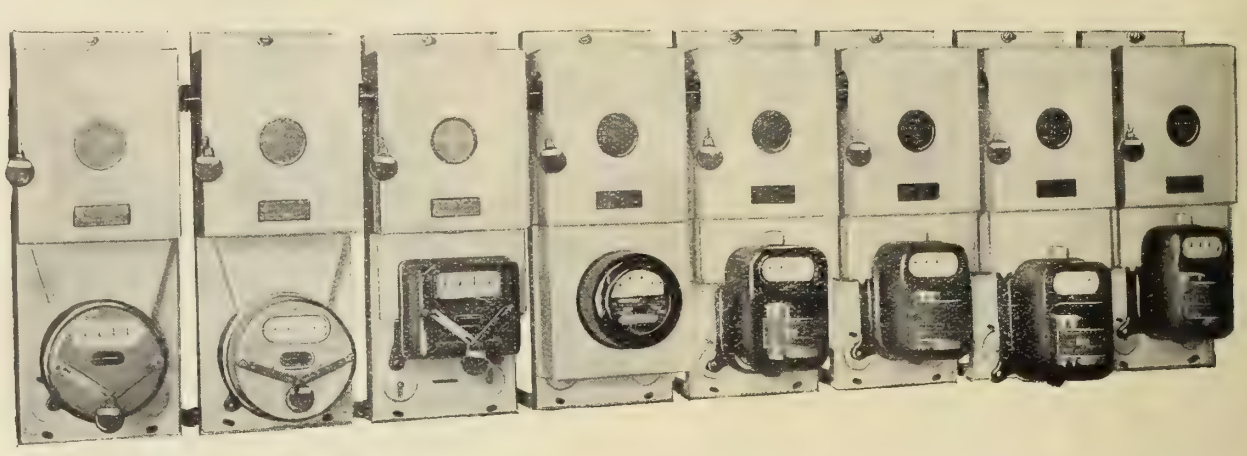
Specifications and tenders for complete installations submitted on application.

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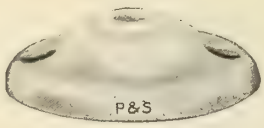


Illustrates a group of several types of meters equipped with Metropolitan Devices.

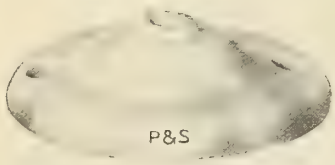
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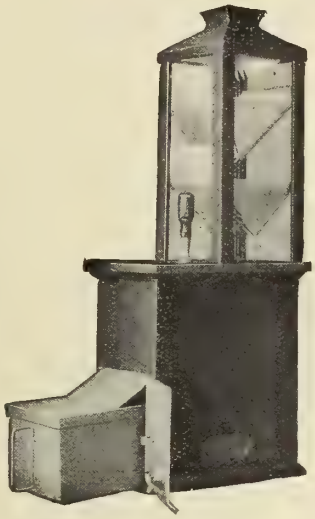
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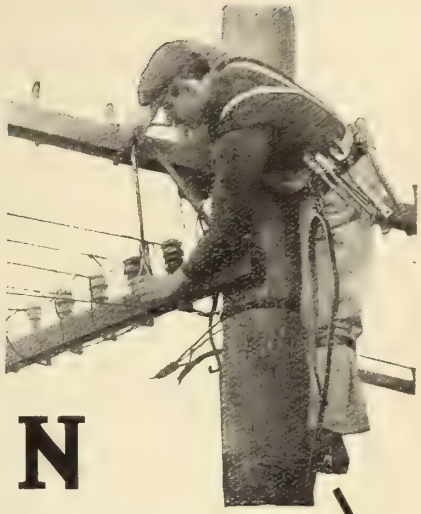


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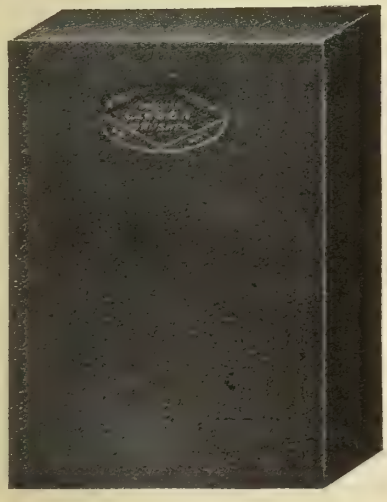
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A Definite Degree of Abrasiveness Is Necessary in Brushes



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A well lighted Type Foundry

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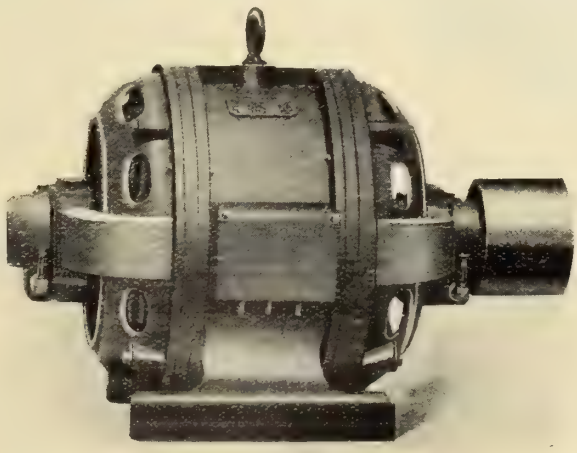
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No. 9070—Grecian Lantern made in five different sizes.

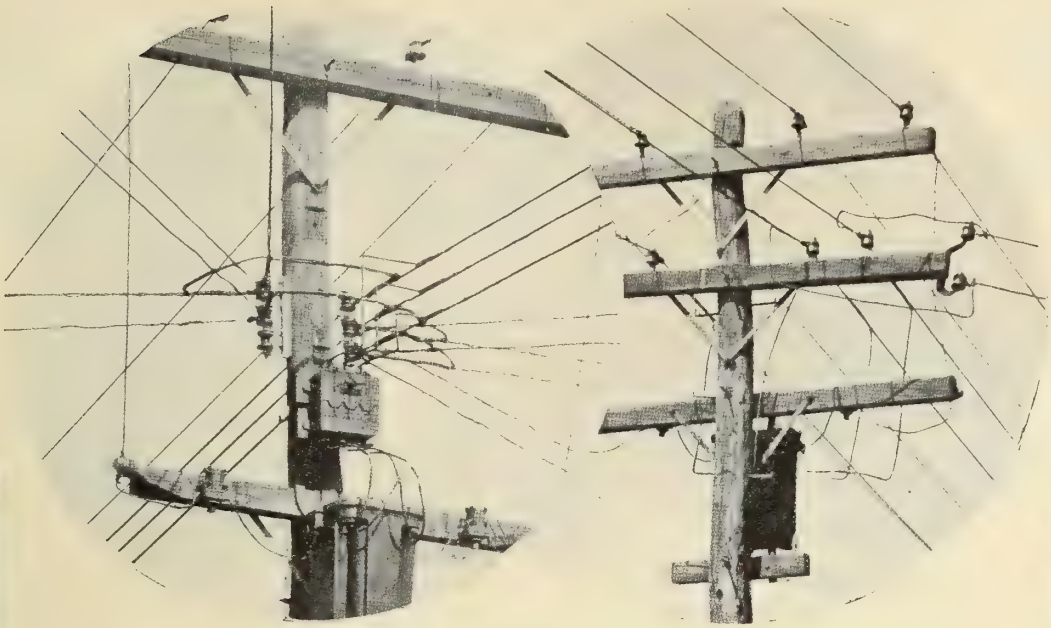
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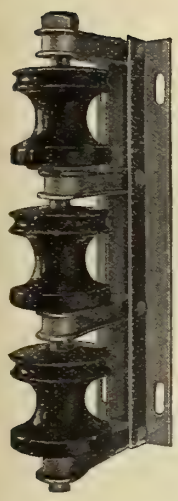
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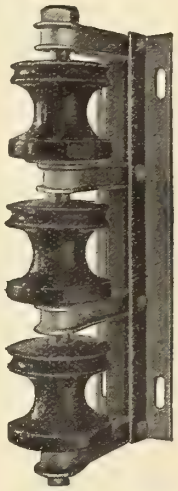
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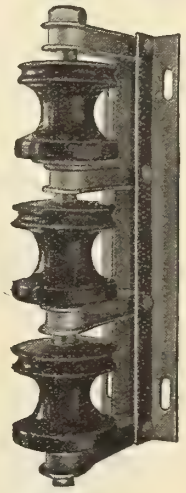


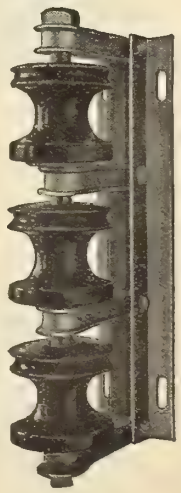












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If you figure in everything from first cost to interest and depreciation, you'll find the saving amounts to nearly 85 per cent.

Remember that Peirce Secondary Racks are backed by the Hubbard Guarantee, which knows no time limit.

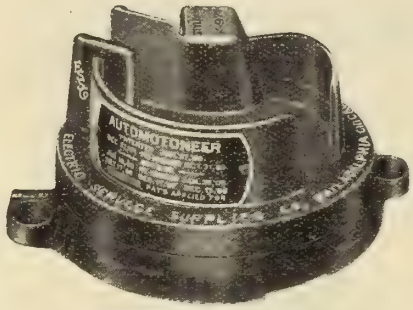
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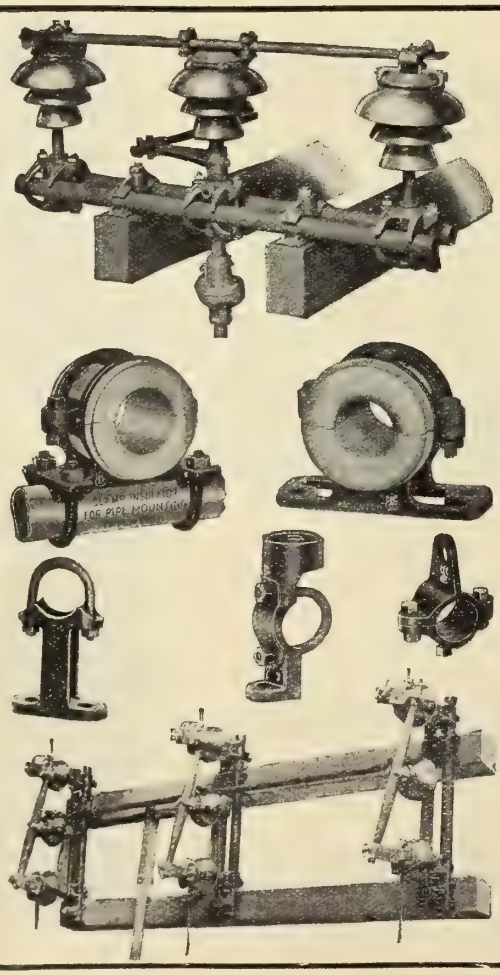
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Electrical News
Generation, Transmission and Application of Electricity

PUBLISHED SEMI-MONTHLY BY

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Vol. 22 Toronto, October 15, 1913 No. 20

Recent Developments in Illumination

Recent developments in illumination have taken place simultaneously along two supplementary lines—greater efficiency in the lighting units themselves and better control of the light these units give out; and remarkable as the advances have been in the former case it would appear that quite as valuable, if less spectacular, progress has been made in the latter. Original cost, operating cost and quantity of light are still important factors in the minds of all light customers, but there is a noticeable increase in the number of employers who place quality before quantity and who recognize that "more work and better work," by their employees, means much more in dividends than keeping down either the initial or operating expenses. The demand for better lighting has necessarily been met by improvements in the design of installation, by a better distribution of the units, a recognition that certain types of light sources have special applications, and, last, by very marked improvements and variety in the manufactured glass-ware. The field of each of the three types of indoor lighting—direct, semi-indirect, and indirect—is becoming more clearly defined and no attempt is now made by the advocates of either one to belittle the value of the others. Direct illumination where only the lower part of the room needs to be lighted, must continue to be the most attractive both as to cost and maintenance, but developments in the art of glass making have raised the efficiency of the semi-direct and the indirect units to such a degree that the greater cost of installing and operating these is not of sufficient importance to offset the many advantages that have been experienced by the use of one or other of these systems in a great variety of installations. In street lighting the tendency is to get away from the clusters, especially on main thoroughfares where a very high illumination is desired. The magnetite and luminous arcs are growing in popularity and the most recent development, the half watt incandescent lamp, will doubtless find a field where a quantity of illumination above the average is required. For residential streets the series low voltage tungstens appear to be gaining in popularity and different successful methods have been devised for the proper regulation of the current supply for these. The neon lamp is a very interesting development of which the commercial value has scarcely yet been demonstrated.

Neon Lamps

Considerable progress has been made in the manufacture of lamps using some inactive gas, such as carbon dioxide or nitrogen within the tube, and more recently the gas neon has been utilized for the same purpose. Neon is a constituent of the atmosphere to the extent of about one part in 66,000 and on account of the difficulties met in its preparation has been looked on as one of the vary rare gases. It has a weight of approximately two-thirds that of air and is exceedingly inactive in that it does not combine with metal or other gases.

Recent experiments by Monsieur G. Claude, in France, on the liquefaction of air have resulted in the production of neon in considerable quantities as a by-product. M. Claude states that with a modest apparatus for liquefying air he has been able to secure 100 litres of neon in one day. Looking around for a use for this gas he has hit upon the idea of utilizing it in tube lamps and in a recent lecture given before the Illuminating Engineering Society, during the recent convention in Pittsburgh, demonstrated the high illuminating efficiency of the neon tube. Tubes were shown of an approximate length of 10 ft. and diameter 2 inches, which gave out very intense light with an efficiency claimed to be approximately one-half watt per candle power. The disadvantage of this light for ordinary illumination is that it is lacking in blue rays and is very rich in red. M. Claude pointed out, however, that since the Cooper-Hewitt lamp has a similar deficiency in red rays these two sources of light, the mercury lamp and the neon lamp, might be made supplementary to one another. This was also demonstrated, a combination of two mercury tubes and three neon tubes of approximately the same size giving an illumination which brought out very accurately the colors in a variegated bouquet shown by the speaker. The commercial value of the neon lamp is not very plainly shown as yet but for certain kinds of illumination, such as sign lighting, where the spectacular effect is desirable, the neon lamp should find a broad field. The life of the lamp is claimed, in its recent development, to be entirely satisfactory.

The Half-watt Lamp

Improvements in the tungsten lamp have constantly been along the line of greater efficiency and longer life. In a general way any improvements in efficiency tended to reduce the useful life of the lamp, as for example, an increase in voltage, which not only shortened the life of the film, but produced blackening of the bulb in a much shorter time. Investigations have been carried on almost continuously to discover the cause of the blackening which was thought at first to be due to certain chemical changes taking place as a result of a trace of water vapor being left in the lamp bulb. Later work by the engineers of the General Electric Company has shown to their satisfaction that the cause of the blackening of the ordinary well-made tungsten lamp, as well as those run at higher than their rated efficiency, is simple evaporation of the filament.

To overcome this evaporation two general methods have been tried with considerable success, (1) introduction of

gases such as nitrogen or mercury vapor, at atmospheric pressures, into the lamp bulb, and (2) the changing of the location of the deposit by means of convection currents in the gases so that the bulb opposite the filament does not darken. The present result is the production of a high candle power nitrogen filled lamp of very high efficiency. In the largest units, from about 1,500 c.p. up to about 7,000 c.p. the efficiency is between .4 and .5 watts per candle with a life of 1,000 hours or more. This takes a current of at least 20 to 30 amperes and operates best on alternating current. In very large units it has been considered best to run the lamp off a small transformer giving a voltage depending on the size of the units, but large lamps running on standard lighting 110 volt circuits have shown an efficiency better than .5 watts per candle power.

The temperature of the filaments is several hundred degrees higher than those of the ordinary tungsten lamp which causes the light to be very much whiter and in reality a near approach to daylight. By the use of special colored screens it is possible to obtain a bright daylight color with an efficiency of about 2 watts per candle.

Lower Rates in Vancouver District

From the beginning of October it has been decided by the management of the B. C. Electric Company to bring the lighting rates in the districts adjoining the city to the same level as those which obtain in Vancouver. To bring the rates in line with those charged inside the city limits represents a decrease of from approximately 27 per cent. to 50 per cent., according to the quantity of current consumed. It has also been decided to effect a reduction in the charge for the rental of meters outside the present limits of the city from 20 to 15 cents per month.

These altered figures will affect thousands of householders, as they cover the municipalities of Point Grey, Burnaby, Richmond, Delta, Surrey, Langley, Matsqui, Sumas, Chilliwack, Coquitlam, Port Moody and other points on the lower mainland of the province served by the company. The following table indicates the reductions which have just gone into force:

	Former Rate	Rate Oct. 1
First 50 kw. hours	$0.15	$0.11
Next 50 kw. hours	.14	.10
Next 300 kw. hours	.13	.09
Next 300 kw. hours	.12	.08
Next 300 kw. hours	.11	.07
Next 500 kw. hours	.10	.06
Next 500 kw. hours	.09	.05
Over 2,000 kw. hours	.08	.04
Meter rental	.20	.15

There is a rebate of 20 per cent. for the prompt payment of lighting rates; the charge for meter rental is net.

Winnipeg Street Lighting

Since inaugurating the city of Winnipeg power plant the street lighting system has increased very rapidly. There are now over 2,000 arc lamps in service, as compared with 220 in the year 1900 and 700 in the year 1905.

These 2,000 lamps are made up as follows:

Alternating enclosed lamps suspended from wooden poles	1077
Magnetite lamps suspended from wooden poles	427
Magnetite lamps erected on ornamental poles	688

The alternating enclosed lamp is confined to the outlying districts, while the magnetite lamp which is a 6.6 ampere luminous arc lamp, is confined to the business district and the central section of the city.

At the present time the city of Winnipeg has some $400,000 invested in street lighting equipment which shows that the capital expenditure per lamp up to date is in the neighborhood of $200. This amount, of course, includes station equipment, real estate and all other accessories belonging to the street lighting department.

In connection with Winnipeg's claim to being one of the best lighted cities in America it is interesting to note the following figures:

City	Population	No. Arc Lamps	Lamps per 1,000 of Population
Boston (proper)	800,000	5,000	6.25
Montreal	500,000	3,200	6.40
Los Angeles	375,000	3,700	9.86
Portland	207,000	2,978	14.38
Vancouver	175,000	1,695	9.66
Hamilton	100,000	846	8.46
Winnipeg	200,000	2,000	10.00

The city is now contemplating the purchase of some carbon flame equipments for use in the outskirts. This is a 10 amp. alternating series lamp and is supposed to possess distinct advantage over the luminous arc in the matter of power factor, all round efficiency, and in the saving of current consumption. The only noticeable difference to the layman between this carbon flame lamp and the luminous arc is that the carbon flame has a slightly yellow tinge which, though noticeable, is not objectionable.

The results in the operation of the street lighting department for the past year in Winnipeg show that the total annual charge for the alternating series lamp is $48, while the luminous arc approximates $63. These figures include interest, depreciation, sinking fund, maintenance and operation.

Vancouver Convention A. I. E. E.

The Annual Pacific Coast Convention of the American Institute of Electrical Engineers held this year in Vancouver on September 9th, 10th and 11th was voted an unqualified success by the representative members in attendance from all points along the Pacific Coast. The meetings were held in the Oddfellows Hall at the corner of Hamilton and Pender streets, which was also the headquarters of the convention and members of kindred engineering sòcieties, many of whom availed themselves of the invitation to register there and attend the proceedings. The convention committees were composed as follows:

General—R. F. Hayward (Chairman), E. M. Breed (Secretary), F. D. Nims, L. G. Robinson and J. R. Reid.

Paper—F. D. Nims (Chairman), D. P. Roberts and W. W. Fraser.

Transportation—E. M. Breed (Chairman), J. R. Reid, J Montgomery, E. R. Pease and H. W. Keefer.

Entertainment and reception—L. G. Robinson (Chairman), R. H. Sperling, J. A. Shand, W. V. Hunt, G. R. Wright and W. J. Lister.

Finance—W. McNeil.

On the opening day of the convention, the visiting delegates were accorded a civic welcome by Alderman Mahon in the absence of Mayor Baxter, and Mr. R. F. Hayward tendered the greetings of the local members, and also introduced Mr. Lightipe, of Los Angeles, as vice-president of the society, who presided throughout the proceedings. During the first afternoon session Mr. C. F. Uhden, chief engineer of Washington Water Power Company, of Spokane, Wash., read a paper on the "Effects of Ice Loading on Transmission Lines" prepared by Mr. V. M. Greisser, an electrical engineer with the same company. This was followed on the succeeding dates of the convention by five other papers, comprising the following: "Mountain Railway Electrification," by Mr. A. H. Babcock of San Francisco, chief electrical engi-

neer of the Southern Pacific Railway. The "Gulf of Georgia Telephone Cable," by Mr. E. P. Labelle and Mr. L. P. Crim, of the British Columbia Telephone Company, Vancouver. "A Modern Sub-station in the Coeur D'Alene Mining District" (Idaho), by Mr. J. B. Fiskin, superintendent of the Washington Water Power Company, Spokane, Wash. "Notes on Oil Circuit Breakers for Large Powers and High Potentials," by Mr. K. C. Randall, chief engineer of the switchboard department of the Westinghouse Electrical Manufacturing Company of Pittsburg, Pa. "Logging by Electricity," by Mr. E. J. Barry, electrical engineer for the St. Paul-Tacoma Lumber Company, of Tacoma, Wash. The papers read at the regular daily sessions were supplemented on the evening of the 10th inst. by an interesting address at the Vancouver Progress Club on the topic "Some Features of the Panama-Pacific Exposition" from Mr. A. H. Halloran.

A note worthy feature in arranging the programme for the convention and one which was evidently popular with all those who were present, was the departure from the usual custom of placing a brief time limit for the hearing and discussion of papers, the decision to allow only six papers to be read during the course of the meetings, permitting an entire half day session in which to deal with each single subject. The popularity of this arrangement may be gauged from the fact that practically everyone out of the average daily attendance of over 100 members remained behind to take part in the discussions.

The attendance during the convention was another gratifying feature, everyone who could possibly spare the time from his usual daily duties being on hand at all sessions. The banquet in the Terminal City Club tendered to the delegates by the local convention committees at the close of the convention, was a most successful event, upwards of 150 engineers being in attendance, the visitors taking the opportunity to express their appreciation of the excellent manner in which all the arrangements in connection with the convention had been carried out.

On Friday, the 12th inst., the delegates, accompanied by a number of the Vancouver section, were the guests of the Western Canada Power Company on a trip of inspection to the company's plant at Stave River Falls, and on the following day the visitors availed themselves of the invitation of the B. C. Electric Railway Company to inspect that company's plant at Lake Buntzen.

Can Supply Power to Portage

A delegation composed of Mayor Taylor, Aldermen Richardson and O'Brien of the city council and J. J. Garland, president of the Board of Trade of Portage la Prairie, waited upon the members of the light and power committee of the city of Winnipeg with the object of discussing the possibility of securing a block of power from the latter city's power plant.

The necessary transmission line and sub-stations for the carrying out of this scheme is estimated to cost $250,000, and will, in all probability, if an agreement is reached, be built and maintained by the city of Portage la Prairie.

This is not the first time that the question of supplying Manitoba towns, other than Winnipeg, with power generated on the Winnipeg River, has come up. During the last few years there have been a number of rumours of such schemes but nothing definite has yet been done. Tenders have been received, however, for from 2,000 to 6,000 cedar poles, 45 ft. in length, 7 in. top, as per Idaho lumbermen's regulations, 2,000 to be delivered f.o.b., between Bird's Hill and Portage la Prairie at intermediate stations not later than November 15th, 1913; the balance of 4,000 to be delivered between Portage la Prairie and Virden at intermediate stations not later than March 15th, 1914.

Tenders for the above were received by H. V. Hudson, secretary and treasurer, Great Falls Power Company, Merchants Bank Building, Winnipeg.

Can Sell in St. Boniface

The question of the right of the city of Winnipeg to sell electric energy in St. Boniface for light, heat and power purposes came up recently before Commissioner Robson of the Manitoba Public Utilities Commission. Commissioner Robson decided that the city of Winnipeg had the right to sell electric energy in St. Boniface, that the public utilities commission had jurisdiction regarding the application and that the only point remaining to be settled was that of the distribution of poles, etc.

This application by the city for the right to supply light and power to a nearby municipality is the fourth which has so far been heard by the public utilities commissioner. The application has been granted in each case. It is expected that in turn all of the surrounding municipalities will receive the attention of Judge Robson in this matter.

Canadian Collieries, Limited

The Hydro-electric plant of the Canadian Collieries, Limited, on the Puntledge River, Vancouver Island, is now operating successfully. At this point there is a possible capacity of approximately 20,000 h.p., only half of which however is being developed at present. The forebay is some three miles above the power house and the water is carried by enclosed pipes, for the most part, of wood stave construction. The first section of pipes is 8 ft. in diameter, and 5,380 ft. in length; at this point the pipe divides by a Y into two pipes 6 ft. diameter, only one of which is being installed at present. The 6 ft. pipe has a length of 4,500 ft. when it again divides and the water is led by two 50-inch penstocks, the first 3,770 ft. of which are constructed of wood staves with steel bands and the last 660 ft. of steel pipe.

Two turbines of the re-action type have been installed, horizontal shafts, direct connected to generators of the revolving field type. The generator characteristics are 13,200 volts, 25-cycles, 3-phase, 500 r.p.m. The normal rated capacity of each turbine is 4,700 h.p. and of each generator 3,500 kw. Though the plant is only one-half completed it is stated that the capital cost has not exceeded $70 per h.p. and that when it is complete this amount will be reduced to about $60. The machines operate under a static head of 350 ft.

Railway Operation at 2,400 Volts

A contract has just been awarded to the Canadian General Electric Company by the Canadian Northern Railway Company for the equipment required in connection with the Mount Royal tunnel and terminal system being constructed by the latter company at Montreal. The line is approximately four miles in length and the equipment will consist of seven electric locomotives, eight or more multiple unit control motor cars and generating, transforming and switching equipment. It might be mentioned in the same connection that the Canada General Electric Company were recently successful in securing the order from the Canadian Pacific Railway for the electrification of the Castlegar Branch of that railway, which is situated in the Kootenay Division. Heavy power locomotives are to be used in each case and the voltage adopted has been 2400 volts, which has been standardized by the General Electric Company and the Canadian General Electric Company for electric service of this nature.

The decision to introduce 2400 volt service into Canada follows the successful equipment of some 114 miles of line of the Butte, Anaconda & Pacific Railway. On this line 17 heavy electric locomotives are operating.

Calgary Power Co. Extensions

By Mr. A. G. McLeish

In former numbers of the Electrical News articles have appeared pertaining to the plants of the Calgary Power Company, including their new extensions and developments on the Bow River, about fifty miles west of Calgary. During the months June to September inclusive their engineers have made rapid strides in accomplishing a large proportion of the hydro-electric construction, estimated to cover a period of approximately one year. The power plant of this company was situated at Horseshoe Falls, Bow River, but in addition to further installations at this point a second development is well advanced at Kananaskis, about 2 miles up stream.

Development at Kananaskis Falls

Above the Kananaskis Falls, and at a point where the Kananaskis River joins the Bow, a horizontal ledge of hard-pan rock provides a suitable foundation for concrete building. This site was chosen for No. 2 dam. During the low-water winter season, a temporary water-run was cut through the rock and built up with concrete for the accommodation of stop-logs when necessary. A coffer dam was built extending toward the opposite bank of the river as far as the increasing flow of water would permit, and laying of concrete went on immediately. With the approach of warm weather in the spring of the present year, with a greatly increased flow from the glaciers, it proved impracticable to attempt to divert the whole stream through the temporary run-way; therefore a natural opening was left at the north bank of the river, the dam to be completed in the near future when the necessary abatement in water flow becomes apparent.

Concrete mixing has been done throughout by two one - cubic - yard steam-driven mixers, situated at one end of the dam, the concrete being hauled on dump-cars from mixers to destination. Sand and gravel was obtained for the whole work on the company's own premises, within a short run from the mixers. For assurance of obtaining a flawless and solid foundation for the dam a Calyx drill has been at work continuously, drilling, and filling up all crevices in rock beneath the dam.

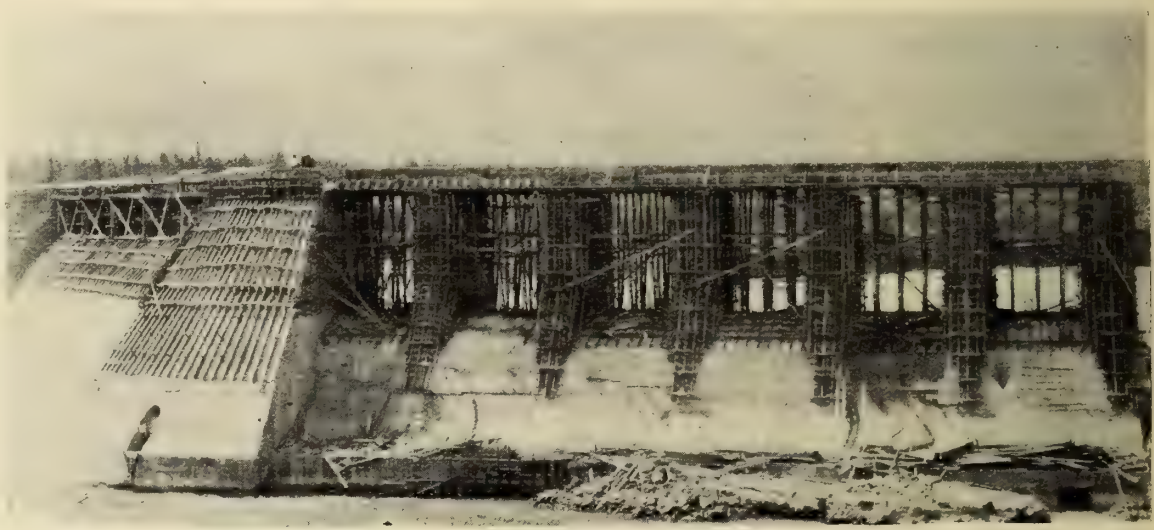
When completed the concrete structure will extend across the river a total length of 800 feet by 57.5 feet in height, built in eleven sections, or stop-log spill-ways. At present the dam is up to its final proportions, excepting the portion at the north end.

Excavation for power house, pressure and draft-tube tunnels and head-water canal is practically completed; the concrete casing in tunnels and draft-tubes is well under way and power house sub-structure is building. A concrete foundation is laid for a 90 ft. by 60 ft. main building, the lower 15 feet of walls also to be of concrete, above which it will be finished with large clay-brick. The head-water canal, encased with concrete from forebay to head works, will assume dimensions of 700 ft. long by 80 ft. wide at the top and 50 ft. at bottom by 19 ft. in depth. From the head works two short concrete penstocks 60 ft. long by 35 by 13 ft. cross-section at head gates, and 12 by 12 ft. at wheel case, will feed directly into the turbines. From the turbines water will be discharged into draft-tubes 30 ft. in length, and varying in cross-section from 9 ft. square at wheel pit to 13 ft. by 16 ft. at entrance of water into tail-race tunnels, whence it is carried down to the lower river. With this completed system a total effective head is obtained of about seventy feet.

Record progress has been made in all excavation work, facilitated chiefly by use of two steam shovels and three hoist derricks, as well as several pneumatic drills, etc. Two locomotives are in service for removal of rock and debris.

Power house foundation and sub-structure is planed and laid out for instalment in the near future of two vertical type Canadian Allis-Chalmers turbines of approximately 5,800 horse-power each, with Canadian Allis-Chalmers governors, to run two Swedish General Electric generators, 4,250 kv.a. There will be one 175 kw. 250 volt turbo-exciter and one motor driven exciter of the same capacity. All switching equipment will be installed by the Canadian Westinghouse Company including a vertical type remote-control switch-board. Installation of power house equipment will be simplified by use of a forty-foot span, 50-ton crane, electrically operated.

Current will be generated in this station, as in No. 1, at 12,000 volts, and transmitted at the same potential over copper wire, three-phase circuits to the present Exshaw transmission line, which is also in process of reconstruction into a double pole three-circuit system.



Calgary Power Company, Kananaskis Falls.—Down stream side of dam.

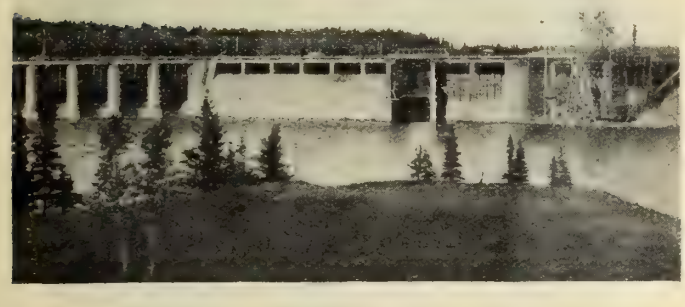
Extensions at Horseshoe Falls

To supply the constantly increasing demand for electrical energy a further extension is being added to No. 1 plant. The fourth penstock has been constructed by the company's own employees and a new 6,000 h.p. turbine installed by the Wellman-Seaver-Morgan Company, controlled by a Lombard governor. A fourth 4,500 kv.a. generator is being forwarded by the Canadian General Electric Company for immediate erection. For this increased capacity two 3,000 kw., three-phase transformers have been placed in operation by the Canadian Westinghouse Company, with additional necessary switching apparatus. No. 1 plant will now have a capacity of 18,000 horse-power and with the two plants combined a total capacity of 30,000 horse-power will soon be available.

Transmission and Switching

The present transmission system consists of two 55,000 volt lines, 50 miles in length, each of No. 0000 stranded alu-

minum cable carried on substantial wooden poles with cross arm construction, serving the sub-station in the city of Calgary, and two 12,000 volt lines, 25 miles in length, of the same construction, serving the station at Exshaw, where transformers and synchronous apparatus are installed to obtain power at an operating voltage with good power factor. Under ordinary circumstances, the two 12,000 volt lines serving Exshaw will be carried by the new plant, and provision has been made in the switching equipment to enable this load to be transferred to the 12,000 volt busses at the present plant. In addition, outgoing feeders will be installed for the purpose of connecting the 12,000 volt busses of the two stations, enabling the new plant to feed the 55,000 volt lines to Calgary through the step-up transformers at the present plant.



Calgary Power Co., Kananaskis Falls.

The switchboard gallery is 19 feet wide, running the full length of 90 feet along the east side of the power house, and contains the station service, exciter, and remote control boards. Generator circuits and outgoing feeders are operated by remote control, electrically operated, circuit breakers installed in the high tension chamber. Owing to the necessity of handling two 12,000 volt incoming lines from the new plant, in addition to the Calgary and Exshaw out-going lines, the installation of three 12,000 volt busses and two 55,000 volt busses was provided for in the original layout of the present plant. Interconnection of the low tension busses provides for the operation of the outgoing lines from a combination of any of the four units in the present plant as well as from either or both of the two units in the plant now under construction, an arrangement of maximum flexibility. In order to handle the increased load on the high tension line, it is intended to erect two additional 55,000 volt transmission lines serving the Calgary sub-station. The survey for the first of these lines has been about completed, and the other will be surveyed at once. The route of these two lines will follow closely that of the most northern of the existing high tension lines. All switchboard and transformer equipment in the operating plant, as well as the switching apparatus for the new plant, was supplied and installed by the Canadian Westinghouse Company, Limited.

Mr. J. G. Glassco, general manager of the City of Winnipeg Light and Power Department, is at present in the east on business connected with the duplicate transmission line to be erected on the right-of-way of the present line. The original intention was to use standard braced towers exclusively in the construction of this line, but owing to late developments in the use of combinations of braced and flexible towers with their consequent monetary advantages it has been decided to more thoroughly investigate the claims of each system. Mr. Glassco will personally inspect a number of transmission systems in the United States and Canada.

Residential Street Lighting

By Mr. A. H. Winter Joyner

Street lighting during the last two and a half years has shown a remarkable improvement in appearance and a corresponding increase in efficiency. In Ontario there has been exceptional opportunity to effect such improvements as an incidental result of the co-operative plan of power distribution under the direction of the Ontario Hydro-electric Power Commission.

Any system of street lighting is a compromise between two extremes. Examples of these extremes may be cited in the case of a tungsten lamp installation. On the one hand a bare tungsten lamp of selected candle power may be suspended on a perfectly plain fixture without any attempt at ornamentation, such bracket being strong enough to require practically no maintenance, and above the lamp a radial wave reflector of large dimensions may be used, thus insuring the highest efficiency and good distribution of light. Such essential devices as ground insulators, etc., might be attached to the outfit so as to be quite secure but not at all of pleasing appearance. An example of the other extreme would be a highly ornamental bracket requiring an undesirable amount of maintenance, supporting a tungsten lamp and opal globe of sufficient density to absolutely obscure the outline of the filament. No doubt in this latter case the appearance of the fixture would be very pleasing but the useful illumination would be comparatively small.

A practical solution of the problem is the use of two or three different types of lighting units to suit the various localities. On the commercial streets good lighting efficiency is essential but with some attention to the artistic needs. In residential districts, pleasing appearance is very important with a due attention to efficiency and a general distribution of the light. On the other hand in an outlying district efficiency is practically the only factor to be considered, although at no time is it necessary to inflict extreme ugliness upon the citizens.

As a general rule small towns from a lighting point of view can be divided into three localities. First, the commercial streets, where the principal stores are located and where a brilliant and artistic effect is desired. In this section some form of cluster pillar lighting has been popular but certainly there appears to be very little either from an engineering or artistic point of view to recommend this for commercial street lighting unless all other poles are removed from the street. In the smaller towns it would seem more appropriate to get equal illumination results without so much expenditure. If the principal streets can be entirely cleared of overhead line construction, including trolley poles, telegraph and electric light poles, some form of electric light standard is, of course,



Fig. 1.

almost necessary and extremely appropriate. In most cases, however, it will be found that a single light unit, whether a tungsten or some of the higher efficiency types of lamp, will be much more appropriate for this class of street than the more ordinary and obtrusive five light cluster.

On the other hand, if poles cannot be moved from the main street the best way to treat the lighting problem is

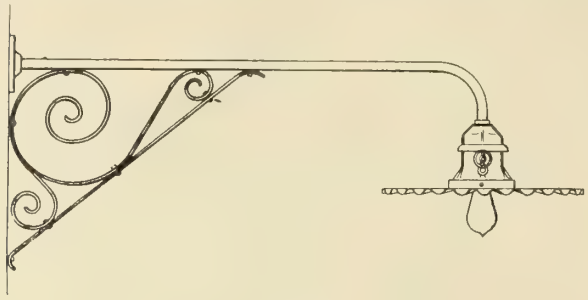


Fig. 2.

by the installation of suitably designed one or two light brackets installed on the existing poles thus escaping still further covering the street with obstructions whether individually artistic or not.

The second general division comprises those streets immediately adjacent to the commercial streets which are of some importance and often contain the public buildings, large residences, etc. As a rule the best way of treating these streets will be either to continue the same class of lighting as is used on the commercial main street or to carry out the general design in a single light unit, using a globe over the lamp and possibly adding a radial wave reflector if regard for low operating expense is desired. If poles have to be kept on these streets, then the fixture would consist of a bracket installed on the same.

The third division includes all the residential and outlying districts. Here it is necessary to use a bracket that



Fig. 3.

is strong but of good design with a fixture of good general appearance but which will cost very little to maintain and will give the highest efficiency and the best distribution of light. The bulk of the lighting being in this district the unit cost must be kept down to a minimum. These conditions are met by the use of a tungsten lamp of appropriate size suitably located on the pole and properly spaced, supported on a simple wrought iron or cast iron bracket and under a radial wave reflector.

A comparison of a few actual installations in Ontario towns will show modern systems which differ materially but have undoubtedly improved the local conditions and given great satisfaction to the citizens.

Fig. 1 illustrates a two-light bracket unit installed on the main street of Oshawa. Two series fixtures fitted with high efficiency ball globes are supported on a T-shaped bracket making a complete unit of pleasing appearance in the daytime and giving good lighting effects at night. The good alignment of these brackets is secured by special adjustable device which was found of great advantage in saving time when the brackets were being installed. There are a number of towns using practically this same type of fixture for their main business streets, including Barrie, Trenton, etc. Should the question of underground distribution be considered at any time in towns of this character such a fixture as this can be removed to the adjacent streets or used for boulevard lighting and some other form of pillar lighting installed in its place. In Oshawa and the above mentioned towns the streets in the immediate neighborhood



Fig. 4

of the principal thoroughfares are equipped with a single light unit having a globe of the same general design as the two-light fixture illustrated. The outlying districts have the type of unit recommended above for such localities as illustrated in Fig. 2.

A very pleasing variation from the ordinary kind of unit has recently been installed in the city of Brantford. Fig. 3 illustrates this unit. The fixture is of the multiple type and as will be noted it is fitted with the well-known Pemco reflector and a clear round bulb tungsten. Efficiency, artistic appearance and durability are combined in this fixture in a very effective manner. In Brantford these brackets are installed over the entire city with the exception of the principal down town streets, where pole top magnetite lamps are being used.

One other interesting installation is worthy of note, an entirely different design of bracket, Fig. 4, used in Paris. It is admirably adapted to the town. The bracket is of massive cast iron, finished in black baked enamel. The fixture is of the series type and the 80 c.p. tungsten lamps are enclosed in high efficiency 10-in. ball globes protected with globe rings, which are well worth the slight additional cost, as they reduce the breakage in glassware. These brackets are used in all parts of the town except on the main commercial streets, where a single light pillar is being adopted.

The Montreal Society for the Prevention of Cruelty to Animals are installing an electric cage for the instantaneous destruction of animals. The electrocution is effected by placing the animal in the electric cage, attaching a metal collar to its neck and closing the door. This act bring into operation a current of 1,200 volts, death occurring in 30 seconds.

Mercury Rectifiers and Magnetite Arcs

By Mr. L. Burpee

At the beginning of 1910 there were in operation in Canada, five Canadian General Electric fifty-light mercury arc rectifier equipments requiring as many tubes. Since that time, or in the last four years, installations have increased at the rate of between 2300 and 2400 light capacity per year so that at present, equipments have been shipped aggregating approximately 9500 lamps and 237 tube capacity. In view of the general interest shown in this system it is perhaps timely to give a brief description of it and of the principles upon which it operates and to give possible explanations of some of the phenomena observed under actual operating conditions.

Both the station equipment and the arc lamp differ radically from earlier types of apparatus. The station equipment receives energy from the constant potential a.c. buses and delivers to the load circuit direct constant current of voltage depending upon the load. The magnetite lamp differs from its predecessors in that the light emanates entirely from the arc which is luminous throughout its entire length.

Station Equipment

In the eight or ten years that this apparatus has been in commercial operation the lamp has been changed only in minor details, though on the other hand the station equipment has undergone a considerable evolution. In the earlier forms, the various component parts of the latter were shipped separately and connected into the system at the time of installation. In these forms the constant current transformer was oil-cooled and the tube air-cooled. In the present form, known as the combined unit, shown in Figs. 1 and 2, the component parts, with the exception of the panel, are mounted on a common base and connected up before leaving the factory, effecting a great reduction in wiring and floor space. In this the constant current transformer is air-cooled, as will be seen, and the tube oil-cooled.

The principal parts of the station equipment are the constant current transformer, d.c. reactance, tube tank, rectifier tube, exciting transformer, static discharges and panel.

It is the function of the constant current transformer to transform constant potential alternating current to alternating constant current. It differs in construction only slightly from the well known C. G. E. transformers for series arc and incandescent street lighting. The difference lies in a tap which is brought out from the middle of the secondary winding which in this case, is the stationary coil to which tap the load circuit is connected. It differs, too, in operation in that but one half of the secondary is active at any instant.

The direct current reactance is connected into the load circuit between the load and the rectifier tube. It is placed here to protect the tube from line surges though its chief function is to act electrically as a fly-wheel does mechanically, that is to absorb energy at the peak of the wave and return it to the circuit at the low point, thus carrying the load over the electrical "dead centre" or the zero point.

The tube tank has a capacity of about 23 Imperial gallons of oil per tube. It is provided with cooling coils that the oil might be kept at the proper temperature and secure the best possible tube life and continuity of service.

The tube, Fig. 3, is a glass vessel containing about one pound of chemically pure mercury and is exhausted to a very high degree of vacuum. Its construction is well indicated in the figure. It receives from the secondaries of the transformer alternating constant current and rectifies it into direct constant current. The process of rectification is perhaps best described by referring to Fig. 5, the diagram of connections. Suppose for instance the current in the primary to be in the direction of a single-headed arrow. In the secondary it will be in the opposite direction as shown. It will pass through the secondary connection to the right hand anode of the tube, thence through the cathode and indicating lamp "L," the d.c. reactance, out to the positive of the load circuit and back to the centre of the secondary coil. With the reversal of primary, indicated by a double-headed arrow, there will be a corresponding reversal in the secondary and the left-half of the coil will become active, current passing through the left hand anode to the cathode, pilot lamp, d.c. reactance, and to the positive side of the load as before; thus with two half waves of opposite direction in the primary there have been



Fig. 1—Latest type mercury rectifier—combined unit.

two waves in the load circuit in the same direction, that is, rectification has been accomplished.

The exciting transformer is a small transformer with a 110 volt primary coil which is connected to the terminals of a small exciting coil placed at the top of the middle leg of the main transformer. As will be seen later on, it is impossible to start the rectifier tube without some means of ionizing the mercury vapor. The exciting transformer is so designed that its secondary short circuit current, occasioned by tilting the tube at starting, cannot rise above a predetermined value which is only slightly above the actual current delivered in exciting the tube. It has three terminals corres-

ponding to those of the main transformer, two of which are connected to the starting anodes and one to the cathode.

The static dischargers in form, are not unlike lightning arresters. They are connected, as may be seen in Fig. 5 between the cathode of the tube and each anode and are designed to prevent the potential of the secondary circuit from rising to a dangerously high point, thus affording protection to the tube and to the transformer secondaries.

The Magnetite Lamp

The magnetite lamp is so constructed that the starting magnet coils are in circuit only long enough for the lamp to

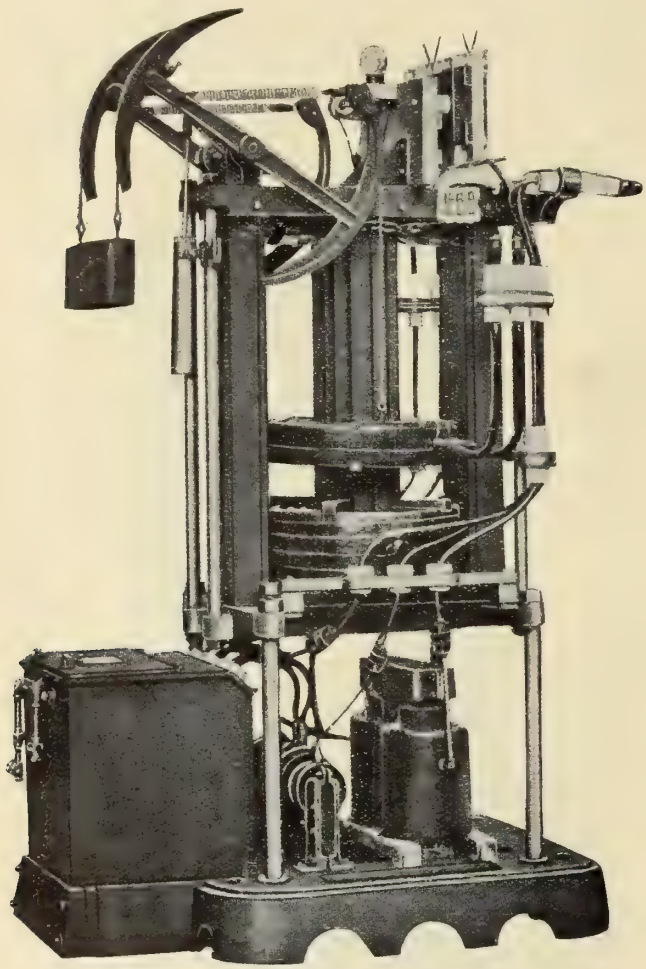


Fig. 2—Combined unit rectifier—casing removed

start or feed. The total losses are about 10 watts so that the electrical efficiency is very high. An internal automatic cut-out affords protection in the event of an interruption of the arc for any reason whatever. The features which differentiate the magnetite from all other lamps are the electrodes. The upper is of pure copper rod within an iron sleeve. It is practically non-consuming requiring replacement but once every 2,500 hours in the 6.6 ampere lamp and every 6,000 to 8,000 hours in the 4 ampere lamp. The lower electrode consists of a thin sheet iron tube filled, principally, with magnetic iron oxide. It is guaranteed for a life per trim of 100 to 125 hours in the 6.6 amp. lamp and for 175 to 200 hours in the 4 amp. lamp. The internal concentric circle enamel reflector placed just above the arc is so designed that its effect, combined with the natural tendency of the arc to give its maximum light in a horizontal plane produces an almost ideal distribution. Reference to Fig. 6, curve A, shows that the candle power of the magnetite lamp attains a maximum intensity of 1,680 c.p. at 10 degrees below the horizontal while that of the direct current 6.6 ampere enclosed arc lamp is but 560 candle power or one-third of the former. The maximum candle power of the latter lamp is 680 at 40 degrees below the horizontal. Since the light falls off as the square of the distance from the source it will be seen that the distribution from curve A is vastly superior to that from curve B. In fact the illumination produced by the magnetite lamp at a horizontal distance of 143 ft. is equal to that of the carbon lamp at 83 ft. (both arcs 25 ft. above ground), although the consumption of energy in the two lamps differs little.

Operation

It has been shown above, how by means of a rectifier, two half waves of opposite polarity are changed into two of the same polarity. The operation of the unit as a whole, under varying loads will now be dealt with. This can probably best be done by referring to Fig. 4, the characteristic curve of a 4 amp., 4,500 volt, d.c. unit. It will be seen that when the load circuit is open or has infinite resistance, the voltage is about 46 per cent. above normal. If the resistance be gradually decreased the voltage will decrease correspondingly in practically a straight line inclined to the horizontal. This will continue until the secondary current has reached normal value, i.e., 4 amps. at which the primary coil, which has up to the present been resting on the secondary coil, that is, in full load position, will begin to float, due to the repulsion between the two coils. A further decrease in resistance will result in a decrease in voltage in a straight line but now perpendicular to the horizontal, there being no change in current. The latter will remain constant until the primary coil reaches the top of the transformer after which further regulation cannot take place. This will correspond to a voltage somewhat less than one-third of normal rating. Any further decrease in resistance will result in an increase in current with a decrease in voltage until short circuit is

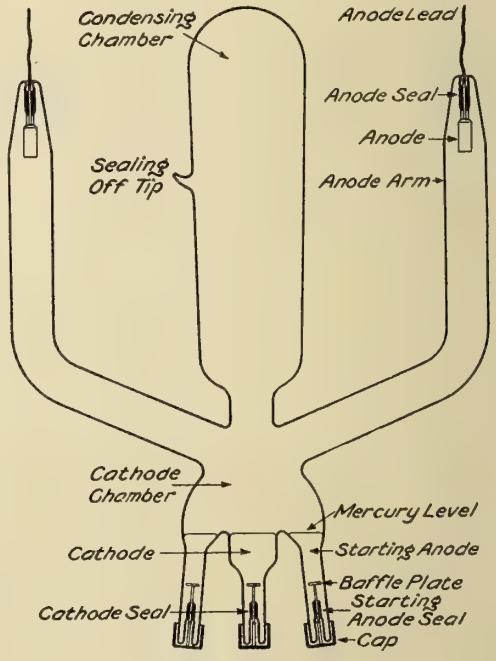


Fig. 3—Rectifier tube

reached, at which point the current will be between 50 per cent. and 60 per cent. above normal. On all rectifier transformers an 80 per cent. load tap is brought out for the purpose of obtaining high efficiency and power factor on light loads. The lower curve in Fig. 4 is the corresponding characteristic.

Phenomena

Considerable speculation has been indulged in in an endeavor to explain why it is that current at ordinary voltage

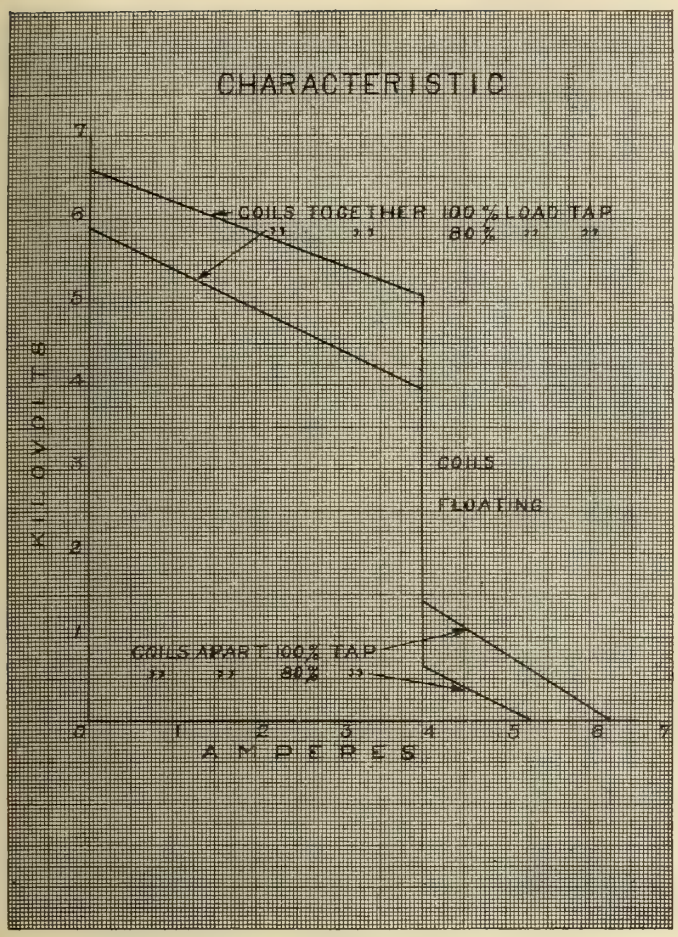


Fig. 4

pressures can pass through the tube in but one direction and how it is conducted between the anode and cathode. No theory, so far as the writer knows, has yet been generally accepted. Apart from theory, the following are interesting facts.

First, that a glass vessel exhausted to a high degree of vacuum offers a very high resistance to current in either direction.

Second, that the presence of mercury vapor, either cold or heated to a high degree, does not affect the situation.

Third, that once the arc is started as by the kick of an induction coil or by other means, the resistance in one direction falls to a very low point allowing a direct current to flow continuously with a potential of 20 volts or more.

Fourth, that the flow of current ceases the instant the arc blast at the mercury pool is interrupted and cannot be started again until the mercury vapor has been acted on by an auxiliary arc.

Fifth, that if an alternating current be superimposed upon a direct current already flowing, only that wave having the same direction as the direct current can pass through the tube.

Sixth, that the temperature at which a rectifier will operate is higher the lower the load voltage even though the current remain constant.

Seventh, that the lower the load voltage the longer will be the average life of tubes.

Eighth, that continuous operation produces a condition of vacuum which, though still good, renders the tube inoperative.

Ninth, that the placing of bell-shaped metal caps commercially known as "static protectors," over the anodes, overcomes the condition mentioned in the last paragraph and renders the tube operative.

Tenth, that when a tube equipped with static protectors again acquires a condition of vacuum under which it will not operate, it may be remedied by boiling and allowing to rest for several months.

The phenomena mentioned in paragraphs 8, 9 and 10 may be explained as follows:

In the manufacture of the tube an effort is made to get as high a vacuum as possible. Every tube is tested under full load conditions and carefully examined after test before being placed into stock so that when shipped it is known to be thoroughly exhausted and in first-class condition. There is, however, apparently a small amount of gas trapped in the glass walls, graphite anode and the mercury, which is only liberated after continued operation under approximately full load conditions. When the tube cools during the day the liberated gases are absorbed by the spongy graphite anodes. Upon starting up again the first rush of current causes the anode to heat, driving out the gas which becomes positively charged. Upon reversal of the current the anode in question becomes negative and as a consequence the positively charged particles of gas adhere to it. In time the amount of gas liberated from the walls, etc., becomes sufficient to make a thin layer over the entire surface of the anode, cutting it off from contact with the ionized mercury vapor, so that upon the next reversal of current, that is when the anode becomes positive again, the arc will not start, though the pressure across the tube is 14,000 volts.

Static protectors approximate a short hollow conductor. It is a well known fact that inside a perfect hollow conductor no electric forces (repulsion or attraction) exist, therefore with protectors placed over the anodes of the tube the particles of gas will not be attracted to the anode and will, therefore, be free to mix with the mercury vapor which

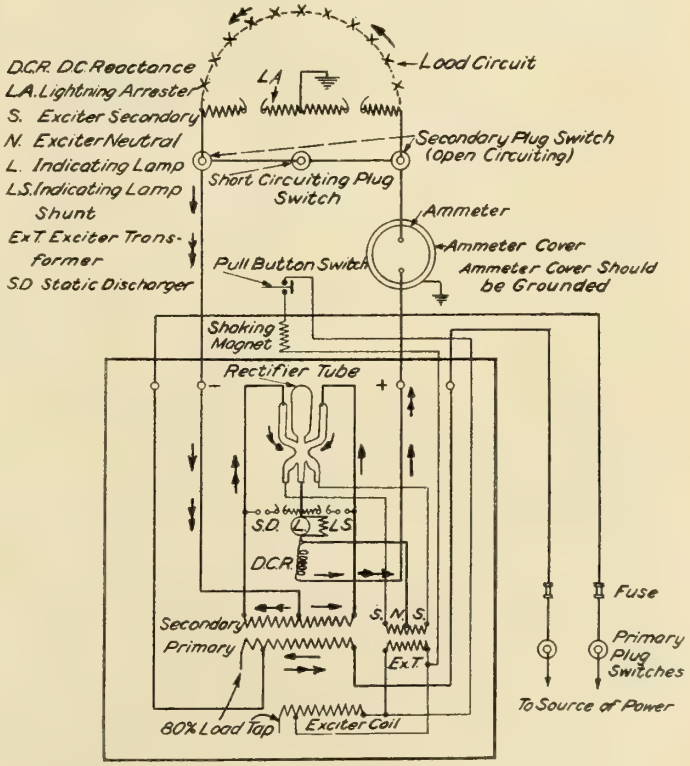


Fig. 5—Connections of single tube rectifier

probably carries them into the condensing chamber during operation, only to be reabsorbed by the anodes when the tube cools again.

The tube will continue to operate in this way for a considerable time with perfect satisfaction. There are, however, deposits forming all the time on the walls which gradually absorb the gases which have previously been giving trouble and raise the vacuum to such a high degree that the tube

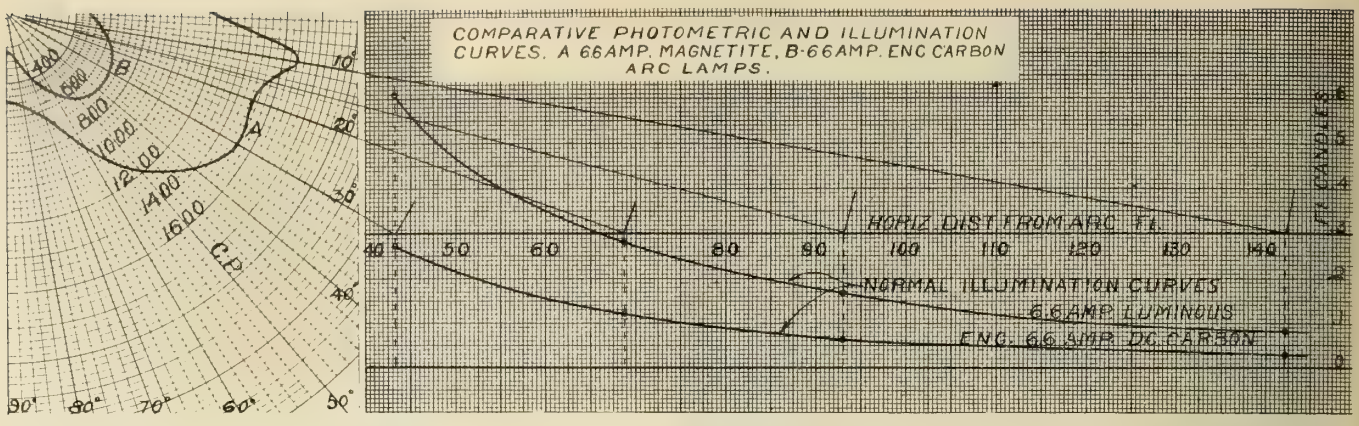


Fig. 6—Comparative photometric and illumination curves—6.6 amp. magnetite and 6.6 amp. enclosed carbon arcs.

again becomes inoperative. By a rest of several months or by gradually heating the tube to between 200 and 300 degrees centigrade, the compounds are broken down and the gases are freed, lowering the vacuum somewhat and restoring the condition necessary to operation.

Performance

Rectifier tubes are guaranteed for an average life of 500 hours but careful operators who have paid attention to the use of static protectors and to washing, boiling and resting their tubes, have succeeded in getting an average life, much above that guaranteed. One installation in the West consisting of thirteen 50-light, 4 ampere single tube outfits, reports an average life on all tubes since the beginning of operation, three years ago, of 1,330 hours with but half of the tubes out of commission. A second installation in the East consisting of two 75-light, 6.6 ampere outfits reports an average life of 2,500 hours on all tubes used in two years with but three out of commission. A third installation reports an average life for 75 tubes on the premises, of 2,600 hours, all of which are in operation or resting for future service. Reports also show that the life of the electrodes of the magnetite lamp is considerably above the guaranteed figure.

Personal

Mr. John Pearson, formerly assistant superintendent Hamilton Street Railway Company, has been appointed superintendent.

Mr. W. A. Lewis, Winnipeg manager Dawson & Company, Limited, is spending a month in the east and will take in the street railway convention in Atlantic City.

Mr. Thomas Rodger has been appointed supervisor of plant with jurisdiction over all matters appertaining to the telegraph and telephone traffic of the Grand Trunk Railway system, with offices at Montreal.

Mr. F. Jno. Bell, general manager of the Canada Wire and Cable Company, is spending some weeks on the Continent. Mr. Bell is accompanied by his wife and daughter and so is making his trip a combination of business and pleasure.

Mr. Arthur L. Mudge, chief engineer Midland Construction Company, sailed on October 4th from Montreal on the White Star-Dominion S.S. Canada, and expects to be in England for several weeks. Mr. Mudge is evidently trying to get as far away from business as possible as there are practically no water power developments in England to engage his attention. We trust he will enjoy to the fullest extent his well earned holiday.

Mr. C. J. McCuaig has been appointed honorary lieut.-colonel of the Fifty-Third Regiment of Sherbrooke. Mr. McCuaig, who is president of the Sherbrooke Railway & Power Company and a director of the Ottawa Light, Heat & Power Company, is also behind the Southern Canada Power Company, just incorporated with a capital of three million dollars, and which is understood to have been formed for the purpose of developing electrical enterprises in the Eastern Townships of Quebec.

Obituary

After an illness of two weeks, Mr. James Ross, C.E., the prominent street railway promoter, director, and manager, died in Montreal on September 20, from heart failure, aged 65. Probably no man in Canada took a more important part in the direction of electric railways than Mr. Ross, although of late years he has not been so active in this connection. Mr. Ross was a Scotchman by birth, and after spending some years in Great Britain and the United States as an engineer, came to Canada. He completed, as a contractor, several important railway jobs, and in 1892, in conjunction with Mr. William Mackenzie, purchased the Toronto railway from the city of Toronto, and rebuilt it, converting it into an electric line. In the same year he re-organized the Montreal Street Railway, which was changed into an electric line. He also converted in a like manner the street railways of Winnipeg and St. John. With Mr. Mackenzie and others in 1897, he secured a charter and franchise from the Government of Jamaica to build electric tramways on the Island.

Mr. Ross was at various times vice-president and managing director of the Montreal street railway; vice-president of the Toronto street railway; president of the Winnipeg and St. John street railways; president of the Dominion Bridge Company, and director of the Canadian General Electric Company.

At a conference held at the beginning of September between the management of the B. C. Electric Railway Company and committees from the various unions concerned in the agreement covering wages and working conditions recently under consideration, the final details of the new agreement were settled and the document signed by both parties. The agreement is to run for two years and covers the employees engaged in the operation of the company's railway department on both the mainland and Vancouver Island. An arbitration committee board was established under the Industrial Disputes Act and consisted of Judge Murphy, Mr. H. O. Alexander (for the Company) and Mr. Cotsworth (for the employees). The minimum rate of 22 cents per hour has been raised to 27 cents but the maximum of 35 cents remains unchanged. This latter rate we believe represents the highest paid by any privately operated railway company in Canada.

Correct and Distinctive Store Illumination

By Clarence L. Law and A. L. Powell*

If one pauses to analyze retail places of business as a whole, it becomes evident that a convenient and complete classification may be made as follows: ordinary small stores, large dry goods and department stores, and high grade shops.

The authors treated the first of these classes in a paper presented at the last convention of the Society; they realized that high efficiency of light utilization, low initial cost of installation, low maintenance and simplicity were the determining factors. It seemed desirable to suggest a standard practice, and an attempt was made to do this on the basis of averages obtained from an investigation of a large number of stores of this class. Some criticism was elicited to the effect that this scheme would produce a monotonous condition, but the fact still remains that artistic appearance cannot be had cheaply, and. due to the small profits earned by a store of this sort, the amount spent for lighting is, of necessity, small.

In the large store, efficiency and artistic appearance become more nearly balanced. Artistic lighting implies good diffusion; and with the present commercial illuminants, this cannot be had without some absorption of light. The merchant can afford to spend a relatively larger sum for lighting than could be spent by the small storekeeper, and some sacrifice of light is made to obtain better diffusion. The store should have a harmonious system of lighting for the main parts of the entire building, yet there are some parts which are, in reality, shops, and should be so treated. The general requirements for department store lighting have been discussed several times in the Transactions of the Society, and there is no need for their repetition in this paper.

A high grade shop should be considered quite differently from the monotonous store which is so common in large cities. Unlike a small store, it should be considered individually and with respect to its particular line of business. This shop is, as a rule, small, handsomely and lavishly furnished, splendidly finished to the minutest detail, and located in the most fashionable section; it handles only the best of goods (frequently imported) and sells to a discriminating class of customers. The proprietor or manager is willing to spend large sums for the right equipment and maintenance. The profits for each individual piece of merchandise sold are undoubtedly greater than in other stores, and therefore, more money can be spent for individuality of equipment. Artistic appearance is the predominant factor, and, therefore, a distinctive system of lighting is necessary, efficiency of the installation being a secondary consideration.

It should be the aim and desire of shopkeepers of this class to interest and attract prospective customers, making them permanent habitues of their stores. Some definite architectural scheme should be carried out or symbolism expressed. Many stores show the influence of the personality of the proprietor, and often such details as the dress of the sales force are in harmony with a certain predetermined plan.

Among the points which should be given consideration by a shop proprietor in planning a distinctive store, may be mentioned the following: Design of the exterior; woodwork of the interior; color of walls and ceiling; finish of show cases; floor covering; finish and type of lighting fixtures, glassware and lamps.

Numerous examples of distinctive store lighting have undoubtedly come to the attention of every one, but a description of a few which the authors have observed may indirectly suggest schemes which will prove of benefit and aid in the advancement of the art of lighting. In last year's paper, the quantitative element in designing the lighting was discussed. A number of stores were grouped under one heading, but with the case in hand where individuality of stores of any one type is the essential, it is necessary to use the "case" system, illustrating by example.

Toy Store

An effective lighting system of a toy store may be seen in F. A. O. Schwartz's store on Fifth Avenue, New York City. The building is of modern construction with a high ceiling supported by pillars. The entire interior, including walls, ceiling and show cases, is finished in white, affording an excellent background for the varicolored toys on exhibition. The store was formerly lighted by nernst lamps with massive ornamental housings finished in gilt. These were of Renaissance design, and in keeping with the capitals of the columns in the main room. The heart-shaped nernst globe was replaced by a 14 in. (35.36 cm.) opalescent glass, acorn type diffuser, and 400-watt clear tungsten lamps were used. Diffusion is good and shadows from pillars and overhanging shelves are minimized.

Store	Window
Length 145 ft. (44.20 m.). Width 41 ft. (12.50 m.). Approximate area 6,000 sq. ft. (557.42 sq. m.). Ceiling height 17 ft. (5.18 m.) Lamps 12 ft. (3.66 m.) from floor. 15 400-watt, 4 250-watt clear tungsten lamps. Total wattage 7,000. Watts per sq. ft. (0.30 sq. m.) 1.2.	60-watt bowl frosted tungsten lamps set in recessed mirrored pockets at front edge of window, spaced about 3 ft. (0.914 m.).

Jewelry Store

Richness and splendor are symbolized by jewels and, therefore, the shop dealing in these, should be magnificently finished. The store of E. M. Gattle, on Fifth Avenue, New York, can well be used as an illustration. All of the show cases and furniture are of mahogany; immense gray marble columns and pilasters with gold capitals support a paneled ceiling, which is also of mahogany finish. The parts of the side walls not occupied by window space are a green tint, decorated in gold. The floor is of oak in parquet style. Light is furnished by eighteen shower fixtures, verde finish, using 40-watt all frosted round bulb tungsten-filament lamps, and in the paneled recesses in the front part of the store are eight cut glass hemispheres, accommodating two 25-watt clear tungsten lamps each. A high wattage is necessary with this system in a room of this style, as the reflection coefficients of the ceiling and walls are very low.

Store	Window
Length 78 ft. (23.77 m.). Width 38 ft. (11.58 m.). Area 2,960 sq. ft. (274.99 sq. m.). Ceiling height 13 ft. (3.96 m.) Lamps 10 ft. (3.04 m.) from floor. 220 40-watt round bulb all frosted 16 25-watt clear tungsten lamps. Total watts 9,200. Watts per square foot 3.1.	2 aluminium finish trough reflectors. 25-watt tungsten lamps spaced about 10 in. (25.4 cm.). Backing of window green plush.

Toggery or Haberdashery Shop

As this class of store caters entirely to men, the store

* Read before the I. E. S. Convention, Pittsburgh.

fittings should not be radical to any appreciable extent. Neatness, simplicity, and up-to-date appearance should characterize the shop. The lighting system must be quite efficient, as a high intensity of illumination is desirable.

The installation of one of the shops of Weber & Heilbroner on Broadway, New York City, conforms excellently with the above requirements. Six-arm brush brass fixtures of well balanced proportions are used with clear 100-watt tungsten lamps and opalescent bowl shaped reflectors. Show cases, counters and woodwork are of polished mahogany; ceiling smooth white plaster; walls above shelves covered with green burlap, and floor of hard wood. The window trim is of circassian walnut, forming an excellent contrast to the dark blue velvet backing for the goods on display. A white fixed shade, extending to within six feet (1.83 im.) of the sidewalk level, serves as a valance.

Store	Window
Length 69 ft. (21.03 m.).	100-watt clear tungsten lamps.
Width 18 ft. (5.49 m.).	Concentrating prismatic reflector.
Area 1,342 sq. ft. (124.77 sq. m.).	Spaced 14 in. in a row along center of false ceiling.
Ceiling height 13 ft. (3.96 m.)	
Lamps 10 ft. 6 in. (3.20 m.) from floor.	
30 100-watt clear tungsten lamps.	
Total watts 3,000.	
Watts per square foot 2.4.	

Millinery

Since Paris is the seat of fashion, to create the proper atmosphere, the display room should be "Frenchy" in character. Mme. Bruck's shop on West Fortieth Street, New York City, may be taken as an example. White show cases, covered with mirrors line the walls, and the dainty furniture is all finished in white enamel. White has the advantage that it does not "clash" with the colored materials of the hats and tend to divert the attention from the goods on display. The ceiling is of smooth, white plaster and a border of satin finish wall paper matches the old rose Wilton carpet and silk window hangings. Two ten-light brass finish shower fixtures with bowl-frosted tungsten lamps surrounded with crystal beaded glass, furnish general illumination. Localized illumination at the mirrors is supplied by side wall brackets, brush brass finish, Empire style, equipped with bowl-frosted tungsten lamps, shielded by crystal and old rose beaded shades. A few plants add to the attractiveness of the room.

Store	Window
Length 40 ft. (12.19 m.).	25-watt clear tungsten lamps in concentrating prismatic reflectors on 2 ft. centers.
Width 12 ft. (3.66 m.).	3 25-watt tungsten lamps in crystal fixtures in center of window.
Area 480 sq. ft. (44.59 sq. m.).	2 sidewall brackets, cut glass shade and 25-watt tungsten lamps.
Ceiling height 10 ft. (3.04 m.).	
Lamps 9 ft. (2.74 m.) from floor.	
Total watts 750.	
30 25-watt bowl frosted tungsten lamps.	
Watts per square foot 1.5.	

Candy Stores

One of the newest and most attractive of New York's Fifth Avenue stores is that of Schrafft. A combination of semi-indirect and totally indirect illumination is used. The front portion of the store serves as a shop and is lighted by five three-light carved alabaster bowls suspended from the ceiling by silk-covered supports, and four one-light bowls, two on brackets and two on short pillars. The ceiling here is tan decorated with raised gold figureing; walls are elaborately decorated, with red, green and blue on a neutral backing. Show cases are of circassian walnut; pillars and floor of marble. A number of small decorative standards are used to illuminate the counters. The rear half of the store is used as a lunch room. In the center of this room is what is apparently a fern-covered urn. This contains a white enamelled reflector and a cluster of clear lamps, the light from which is directed to the cream colored ceiling and walls, lighting the room indirectly.

Store	Window
Length 74 ft. (22.55 m.).	Finished in circassian walnut; roof recessed with mirrored pyramidal reflectors and 25-watt clear tungsten lamps installed in squares on 18 in. centers.
Width (average) 17 ft. (5.18 m.).	
Area 1,200 sq. ft. (111.48 sq. m.).	
Ceiling height 14 ft. (4.27 m.).	
Lamps 10 ft. (3.05 m.).	
5 150-watt clear tungsten lamps.	
4 40-watt clear tungsten lamps.	
15 60-watt clear tungsten lamps.	
Total watts 1,810.	
Watts per sq. ft. 1.5.	

Delicious sweets of great variety originate in the Far East, and an Oriental scheme of decoration for a candy store is, therefore, often appropriate. In Page & Shaw's Fifth Avenue Shop the window is partially covered with a delicate tracery of red, green and blue leaded glass; at night this is accentuated by illumination from lamps in the ceiling of the window. Three metal and art glass hanging fixtures are also part of the window equipment. Free use of the primary colors is made in the decorating of the walls and ceilings of the store with conventional Moorish figures. The floor is of composition, red and white mosaic. It can be safely said that no two of the interior lighting units are alike. Oriental metal and colored glass domes, pottery vases lighted from within and silk-covered lanterns furnish a very low intensity of general illumination, with a higher value on the counters and show cases.

The cashier's desk is surrounded by leaded glass made in the form of a miniature Turkish house, the whole surface of which is illuminated by a number of line source tubular tungsten-filament lamps concealed in its interior.

Store	Window
Length 30 ft. (9.14 m.).	Roof recessed with mirrored pyramidal reflectors; one ft. centers; clear 16 c.p. round bulb carbon lamps; 2 60-watt all frosted round bulb and 3 25-watt regular tungsten lamps in hanging lanterns.
Average width 15 ft. (4.57 m.).	
Area 450 sq. ft. (42.8 sq. m.).	
Ceiling height 10 ft. (3.05 m.).	
Lamps 5 to 7 ft. (1.52 to 2.13 m.) from floor.	
Total watts 900.	
Watts per square foot 2.0.	

Grocery Store

A neat, attractive display will cause trade to flock to the store which is properly arranged. Cleanliness is a very important point to remember. There is no demand for a system of decoration for this class of store, but the walls, pillars and ceiling should have frequent painting. A dark wainscoting, the color of the shelves and show cases, with neutral walls and ceiling, makes an attractive combination. Almost any lighting unit which is neat and inconspicuous will serve.

Store	Window
Length 70 ft. (21.33 m.).	100-watt clear tungsten lamps in concentrating prismatic reflectors spaced 2 ft. 6 in. (0.76 m.).
Width 40 ft. (12.19 m.).	
Area 2,800 sq. ft. (232.25 sq. m.).	
Ceiling height 14 ft. (4.27 m.).	
Lamps 11 ft. (3.25 m.) from floor.	
10 250-watt tungsten lamps.	
Total watts 2,500.	
Watts per square foot 0.9.	

D. M. Welch & Son's store in New Haven, Conn., serves as an illustration of the above requirements. The counters

and show cases are of hard wood, natural finish; the trim is dark green; and the ceiling and walls are painted a light tint. Neatness is particularly characteristic. Two hundred and fifty watt tungsten lamps, in totally enclosing prismatic reflectors are used for general illumination. The unit is efficient and a satin finished lower half provides excellent diffusion. A short brush brass chain with canopy serves as the fixture.

Tea Room

Coziness is the keynote of success of these establishments. A number of years ago a young woman started in a small way to sell home-made candy and pastry among her friends. Her energies soon developed into a methodical business system, and her products sprang rapidly into favor, with the result that "Mary Elizabeth" has branch shops in many of the large cities. Her New York store located on Fifth Avenue, is finished in white on the outside, with her facsimile signature in black serving as a sign.

The shop itself is modelled after a New England interior of fifty years ago; the ceiling is low and finished in white plaster; the floor of white boards is painted a dark yellow and covered here and there with rag carpet "runners." The tea room proper is in the rear. On the right is an old fashioned fire place, and on the left a number of "stalls" similar to those found in taverns of bygone days. Small tables, covered with spotless linen, and gilt chairs are arranged in an attractive manner. Shelves, counters and windows are trimmed with dainty white material.

Light is furnished by tungsten lamps in shirred silk shades which have a slight touch of color. Sixteen of these are attached to ceiling outlets and eight are on wall brackets.

The atmosphere of the room is extremely inviting and the scheme of decoration well executed.

Store	Window
Length 62 ft. (18.90 m.).	40-watt tungsten lamps in shades as used in the store; row in the center of ceiling; 2 ft. (0.61 m.) centers.
Width (average) 18 ft. (5.49 m.).	
Area 1,110 sq. ft. (103.11 sq. m.).	
Ceiling height 8 ft. (2.44 m.).	
Lamps 7 ft. (2.13 m.) from floor.	
24 40-watt clear tungsten lamps.	
Total watts 960.	
Watts per square foot 0.9.	

Shoe Store

Most stores of this class have a center bench arrangement, the entire wall space being covered with boxes on shelves. A room of medium width will require at least two rows of units to give satisfactory illumination on the labels on the boxes and at the foot rests where the shoes are fitted and inspected.

A particularly novel layout is that of Frank Brothers' Fifth Avenue (New York) shop. Entering from the street, one passes into the rotunda about 16 feet in diameter, the dome of which is supported by Corinthian columns. The floor is of mosaic marble and the ceilings, cream colored, with raised plaster decorations. Show cases, with attractive dressings, are grouped about the room. Suspended from the center of the dome is an ornamental inverted fixture containing eighteen lamps. This consists of six diffusing glass globes, pressed into the form of huge shells; below these are four round bulb carbon lamps enclosed in amber beaded glass.

The store proper is rectangular in shape and a balcony 6 feet (1.83 m.) wide extends completely around the interior. The cream colored ceiling beneath the balcony is divided by beams into squares. In the center of each square is a lighting fixture consisting of five pieces of pearl-like glass in the form of a large shell; a 40-watt clear tungsten lamp is located above each shell. At the base of the shell is a 25-watt round bulb all frosted tungsten lamp.

On each pillar from the balcony to the ceiling are located two two-arm brass brackets with clear gem lamps in roughed glass spheres. These serve to light the balcony and the center portion of the store proper.

The oak parquet floor is partly covered with rugs; the furniture is leather covered and the showcases and shelves are of mahogany.

Store	
Length 64 ft. (19.5 m.).	Total watts 7,000.
Width 24 ft. (7.32 m.).	The value of watts per sq. ft. would be of little significance, as two types of lamps are in use, and also both the balcony and main floor are lighted.
Area (main floor) 1,540 sq. ft. (143.07 sq. m.).	
Height under balcony 8 ft. (2.44 m.).	
Height above balcony 10 ft. (3.05 m.).	
17 25-watt round bulb tungsten lamps.	Windows
85 40-watt clear tungsten lamps.	Mirrored trough reflector with 50-watt Gem lamps, outlets on 9 in. centers.
64 50-watt clear Gem lamps.	

Antique and Curio Shop

In many cases the lighting requirements of an antique store are similar to those for a high class furniture store, that is, a low intensity of diffused light suffices. Exposed light sources are very objectionable, as the polished surfaces show the reflection and glare is to be deplored in viewing the rare pieces on exhibition. Quite often the lighting units themselves are "objects d'art." Such is the case in the shop of Lewis & Simmons, where hand carved alabaster bowls with clusters of clear lamps furnish semi-indirect illumination.

The white ceiling, walls covered with dark red velvet and tan velvet carpet, make a good color combination for displaying the goods by contrast.

Store	Window
Length 48 ft. (14.63 m.).	Mirrored trough reflector with 25-watt clear tungsten lamps spaced 8 in. (0.20 m.) apart along the top of windows, and upright at the two sides to a height of about 4 ft. (1.22 m.).
Width (average) 13 ft. (3.96 m.).	
Area 630 sq. ft. (58.57 sq. m.).	
Ceiling height 14 ft. (4.27 m.).	
Lamps 8 ft. (2.44 m.) from floor.	
20 40-watt clear tungsten lamps.	
Total watts 800.	
Watts per square foot 1.3.	

Book Store

Scribners' new store, Fifth Avenue, New York, is an excellent demonstration of a carefully planned and well-executed scheme of lighting. The ceiling of the main bay is vaulted and is of light gray sandstone with white plaster panels. This is lighted by means of line source tungsten lamps (approximately 25 watts per foot) the reflectors being located above the moulding running around the cove. Fourteen opalescent glass bowls, equipped with clusters of three lamps

Store (main bay)	Windows
Length 98 ft. (29.87 m.).	No special lighting, as the windows extend to the top of the arch and the whole store is a flood of light.
Width 28 ft. (8.53 m.).	
Area 2,740 sq. ft. (254.5 sq. m.).	
Ceiling height (maximum) 30 ft. (9.14 m.).	
Lamps 9 ft. (2.74 m.) from floor.	
128 35-watt tubular tungsten lamps.	
42 40-watt clear tungsten lamps.	
Total watts (approx.) 7,580.	
Watts per square foot 2.8.	

each, hung from the ceiling by long brass rods, furnish a feature which seems desirable, viz., a visible source of illumination. The book racks and balconies in the side bays are lighted by 60-watt clear tungsten lamps in opalescent bowl-shaped reflectors. Paintings on the rear wall are lighted by individual mirrored trough reflectors equipped with 25-watt clear tungsten lamps on one foot centers. The entire front of the store is of plate glass, thus furnishing an excellent supply of daylight, and the cases and shelves being of light oak give the room a most cheerful appearance.

Ladies' Wear

This type of shop is really divisible into two classes; namely, general and specialized.

As an example of the first class, the Fifth Avenue (New York) store of J. M. Gidding, may be given a little attention. The lighting units are of the "sunburst" type, consisting of 6 regular and 6 round bulb, all-frosted tungsten lamps below a gilded composition plate, all suspended by a single chain. The fixtures are pleasingly harmonious with the cream colored ceiling and delicate gold lining. Show cases and woodwork are of magnificent circassian walnut, which blends well with the rich carpet of green and tan. The wall visible above the dressing room is largely covered with gilt figures.

Store	Window
Length 55 ft. (16.76 m.). Width 48 ft. (14.63 m.). Area 2,640 sq. ft. (245-25 sq. m.). Ceiling height 12 ft. (3.66 m.). Lamps 9 ft. (9.74 m.) from floor. 90 20-watt all-frosted tungsten lamps. 90 25-watt all-frosted tungsten lamps. Total watts 4,050. Watts per square foot 1.5.	Mirrored trough reflector with 25-watt tungsten lamps on 9 in. centers. White false ceiling, with two alabaster carved bowls, equipped with 6 40-watt tungsten lamps each, are suspended from this. Base and trim of window circassian walnut.

The specialized ladies' wear shop is exemplified by the shop of W. B. Crocker, which handles mourning goods exclusively. The scheme of decoration is very appropriate. As one observer remarked, "A sombre cheerfulness fills the room." A rich gray carpet is but a shade darker than the wall covering, which, in turn, matches the woodwork of the show cases and trim. The chairs are of gray oak and tables of wicker work. The ceiling is white, and suspended from this by long chains are four seven-light and one fourteen-light shower fixtures, dull silver finished. Low wattage, bowl-frosted tungsten lamps are used with diffusing shades.

Under the balcony at the rear of the store are full-length mirrors. Localized illumination is provided at each by a 25-watt all-frosted round bulb tungsten lamp. In the front portion of the store, the general illumination is supplemented by two-arm brackets similar in finish and equipment to the overhead units.

Store	Window
Length 76 ft. (23.16 m.). Width 16 ft. (4.88 m.). Area 1,210 sq. ft. (112.4 sq. m.). Ceiling height 18 ft. (5.48 m.). Lamps 10 ft. (3.05 m.) from floor. 60 15-watt bowl-frosted tungsten lamps. 18 25-watt round bulb tungsten lamps. Total watts 1,390. Watts per square foot 1.15.	Mirrored trough reflectors equipped with 50-watt Gem lamps on 9 in. centers. Woodwork gray. Mirrors at side. Beaded crystal hemisphere set in center of the ceiling.

Restaurant

There seems to be no definite practice with regard to the lighting of rooms of this nature. Some proprietors desire a great flood of light and the attendant sparkle as produced by crystal chandeliers; others demand a soft, well-diffused, low general illumination supplemented by localized table lamps. Bergfield's restaurant, on Broadway, New York, is an example of lighting with the latter idea of proper lighting. Totally indirect single unit, mirrored reflector lighting units of composition moulded into an Egyptian design are used. Mirrors are set into the wall panels, and above each is a two-arm verde finished bracket with low-wattage multiple lamps and silk shades. The wood work is cream, with gold decorations; ceiling white; wall panels old rose, satin finish; chairs mahogany finish, and the carpet a neutral green.

Store	Store
Length 77 ft. (23.47 m.). Width 27 ft. (8.23 m.). Area 2,080 sq. ft. (193.23 sq. m.). Ceiling height 13 ft. (3.97 m.). Lamps 9 ft. (2.74 m.) from floor.	5 250-watt clear tungsten lamps. 4 100-watt clear tungsten lamps. 68 10-watt clear tungsten lamps. Total watts 2,330. Watts per square foot 1.1.

Delicacies

The Specialty Shop in Boston, has a dark wainscoating about 6 feet (1.83 m.) high; above this the walls are divided into panels; in each of these panels is set a heraldic design, which has been adopted by the proprietor as a trade mark. The ceiling is white, glazed, and divided into polygons by the moulding. The show cases and counters are divided into panels which are practically replicas of the wall panels The floor is mosaic tile. The lighting system is remarkably in accord with the general scheme. Between adjacent panels is a torch fixture with an upright lamp and diffusing ball. Counter standards, wall brackets and four-arm ceiling fixtures carry bowl-frosted tungsten lamps and pyramidal art glass shades which are finished to match the counter and wall trim. A most pleasing harmony is secured.

Store	Store
Length 72 ft. (21.94 m.). Width 40 ft. (12.19 m.). Area 2,880 sq. ft. (267.55 sq. m.). Ceiling height 20 ft. (6.09 m.). Lamps 18 ft. (5.48 m.) from floor.	25 60-watt tungsten lamps. 14 25-watt tungsten lamps. Total watts 1,850. Watts per square foot 0.65.

Conclusion

A sufficient number of individual installations have been described to indicate quite clearly that the lighting system should blend with the general scheme of decoration. The illuminating equipment, rather than being dazzling, glaring or commonplace, is inconspicuous, and forms a part of the furnishing of the room.

It must be borne in mind that the methods outlined above are not the only correct schemes of lighting to use; often in the laying out of an installation the ideas or desires of the proprietor will produce considerable deviation from the scheme which would be most in keeping with the period of architecture that is being followed.

From the descriptions given, it can be seen that one is able to apply the commercial diffusers and reflecting devices to almost any class of service. As far as possible the endeavor has been made to discuss stores which had standard equipment, thus showing that there is no necessity for the design of special auxiliaries. Expanding this idea slightly, the authors believe that the stores described are distinctive and yet, with the exception of the carved alabaster bowls, the initial cost is relatively low.

These illustrations might have been continued at great length and an appropriate use found for almost all the equipment listed, but this is obviously out of the question, so the paper can well be closed with the admonition. In designing the lighting for shops of the class treated in this paper, use discretion in the selection of lighting units and do not offer the prospective customer something which is, on the face of it, purely utilitarian,

High Voltage Transmission Systems

A Review of their Electrical and Mechanical Design with Special Reference to the Equipment of the Shawinigan Water and Power Company (Con)

By Mr. Julian C. Smith

This high frequency oscillation striking the end turns of a transformer does two things, it creates a high voltage between the turns forming the end of the transformer, and at the same time, by suddenly changing the conditions which may be called the static conditions existing in the transformers, it changes the potential existing between the different sections of the transformer winding.

These sections act to some extent like the plates of a condenser, and when there is a sufficiently large difference of potential between them, a discharge is apt to occur through the oil from one section to the next and the transformer fails.

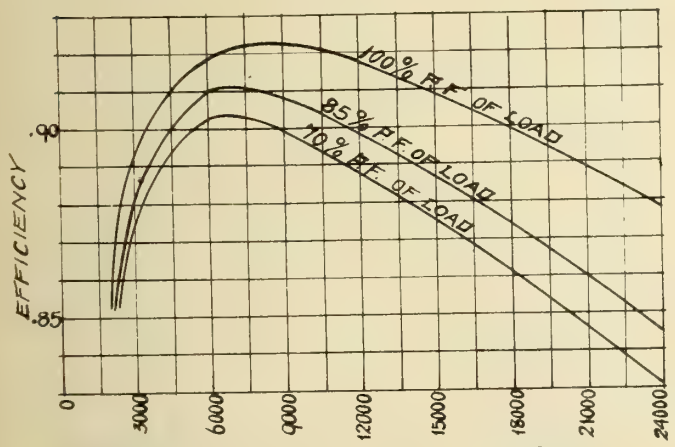
Thus one has an explanation of the breakdown of transformers on the interior of the winding, which is due perhaps to a disturbance striking the transformer from without.

These voltages between sections of a transformer are very high. For example, in a single phase transformer of 4,000 kilowatts capacity, built for 60,000 volts, there may be about 3,000 volts normal potential between the sections of the high tension winding.

To break down the insulation in this transformer at normal frequency requires about 60,000 volts, and yet many transformers have broken down under these conditions, showing that the strength of the insulation required at this particular point in a transformer subject to such oscillation, must be more than twenty times that required at the normal voltage.

Whenever there is a sudden marked change in the electro-static capacity per unit length in a line, as for example occurs where the line passes through wall bushings or transformer terminals, there are apt to be breakdowns caused by potential stresses, which may be localized at these points.

The writer is of opinion that the electrolytic lightning

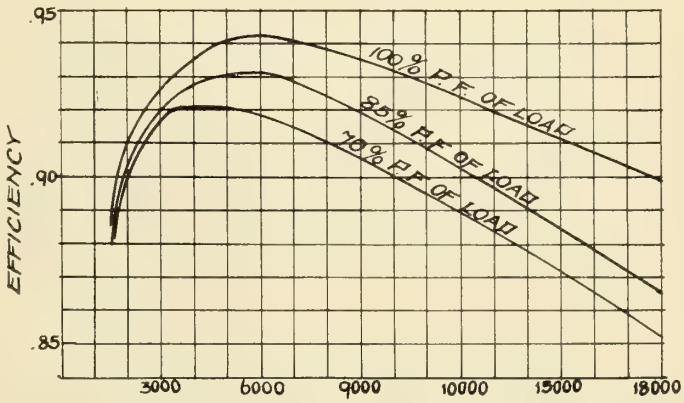


Efficiency curves for one line and two banks of transformers at each end

arresters have not proved to be a cure for all lightning disturbances. Outside of the facts mentioned above, on account of which the arrester may prove to be a menace to certain apparatus on the line, it seems that the arrester is not capable of discharging the heaviest oscillations which occur in practice on long transmission lines. This may be due to the fact that the arresters are not built today to take care of current rushes of more than a few hundred amperes, whereas, when the disturbances due to lightning are exceedingly heavy, the arrester may be called upon to discharge several thousand amperes. Thus in a big system, the writer believes that it is wise to provide some other means of relieving the voltage on the line.

The electrolytic arrester seems to have taken its place as the best lightning arrester which has been developed up to date, and doubtless further improvements will be made which will make the electrolyte and the film on these arresters of a more permanent nature and will eliminate the troubles which have already been experienced with them in service.

It is now common practice to erect ground wires usually



Efficiency curves for one line and one bank of transformers at each end

of 3-8 in. stranded steel cables above the power conductors. If the design of the tower permits, the usual custom is to erect two or three of these ground wires.

It seems to be well established that the ground wires afford a certain amount of protection from lightning disturbances, and practically all new transmission lines are being equipped with these ground wires.

The design of the towers must be very carefully gone into and the sags of the steel wires and the conductors very carefully worked out, in order to prevent the ground wires coming in contact with the conductors under any conditions which arise during operation.

Various methods of working out the position of the wires at all points of their travel have been elaborated, and these methods must be applied for the different spans, and the location of the ground wire with relation to the other wires adjusted, so as to avoid trouble.

It is also customary to install section switches so that the line may be opened for testing purposes. The location and number of these switches depend so much upon the general character of the country through which the line passes, as well as the reliability of the line, that no general statement can be made. As any break of the continuity of the transmission line is to be avoided if possible, the number of sectionalizing switches should be kept a minimum.

On such a system as the Shawinigan, which consists of anchor towers located about one per mile, an easy method of opening up the line is provided.

MECHANICAL DESIGN

The general mechanical design of the transmission line can be divided into four parts, the conductors, the insulators, the supporting structure and the foundations.

Conductors

The two principal materials used for conductors for long distance transmission lines (at the present time) are copper and aluminium. In some cases iron is used where a small amount of power is to be transmitted for a considerable distance, and where the economic size of copper would be too small to be safe mechanically. Copper clad wire is also in use to a considerable extent for special crossings where it is desired to obtain a great strength.

In the designing of transmission lines, the following figures may be considered to be present practice.

Material	Ultimate Strength	Elastic Limit	Modulus of Elasticity	Coefficient of Expansion
Copper (hard drawn)	60,000	30,000	12-16,000,000	.0000096
Aluminium	28,000	14,000	9,000,000	.0000128

Only the purest copper or aluminium can be used, as very slight impurities greatly affect the conductivity.

Insulators

Two widely different types of insulators are in common use; the pin type being used for voltages up to 60,000 volts, and the suspension type for voltages from 60,000 to about 140,000 volts.

The characteristics of these two insulators are quite different. Investigations on the phenomena taking place at times that insulators flash over, and to determine the reason why certain types are better than others, have indicated that the electrostatic capacity of one part of the insulators to another part has a very important bearing on the efficiency of the insulators.

The distribution of the potential from the conductor to the ground, that is to the point of support of the insulator, is not uniform, the potential gradient being very much steeper close to the wire, and becoming more uniform as the ground is approached. Thus that portion of the insulator which is close to the conductor has to stand a greater dielectric stress.

For low voltage, that is below 60,000 volts, pin type insulators can be constructed which give reasonably good performance.

These insulators, under stresses due to lightning or other high potential and high frequency disturbances, fail often by puncture, showing that the material does not have sufficient dielectric strength to withstand the potential stress.

On suspension type insulators it is customary to use about six or seven units for 100,000 volts, and ten units for 130,000 volts, each unit having a flash over of about 55,000 volts. The following table gives the breakdown voltages of different numbers of a standard make of insulator.

No. of Units	Breakdown dry	Breakdown wet
No. 1	85,000	57,000
No. 2	164,000	108,000
No. 3	231,000	156,000
No. 4	260,000	210,000

From the theory which has been elaborated on insulator performance, it would seem that when it becomes necessary to obtain insulators for voltages above present practice, that is about 150,000 volts, such insulators must take the form of suspension type insulators, and the string of units will not be uniform. The insulators nearest the conductor will be designed with larger capacity than those nearest the ground so as to make the potential gradient as nearly uniform as possible.

In general, it is desirable that the insulators be so designed that they will not puncture under any conditions, but will arc over, either directly through the air, or across the surface of the porcelain, before the puncture takes place.

The materials of which the insulators are constructed will doubtless be improved, and we hope to obtain insulators having proper electrical characteristics, which will stand the arc of flashover without being destroyed.

Supporting Structures

The two main types of supporting structures may be said to be wood poles and steel towers. There are also some lines built of wood towers, and few other lines built of reinforced concrete poles.

Owing to the weight and cost of the towers, the design of these structures has been brought to a very efficient point, and the designers of the manufacturing companies in Canada and the United States are able to make their calculations so that each member of the tower performs its functions and the whole tower carries the load for which it is designed without any waste material.

It is customary to specify towers which will have certain spacing of conductors and which will stand certain loads. The following is the specification for the suspension towers of the Shawinigan line, as regards loading:

15,000 lbs. along or across the line, applied at the intersections of the upper cross arm with the tower axis.

3,000 lbs. at any two of supports for insulators for ground wires, a total of 6,000 lbs.

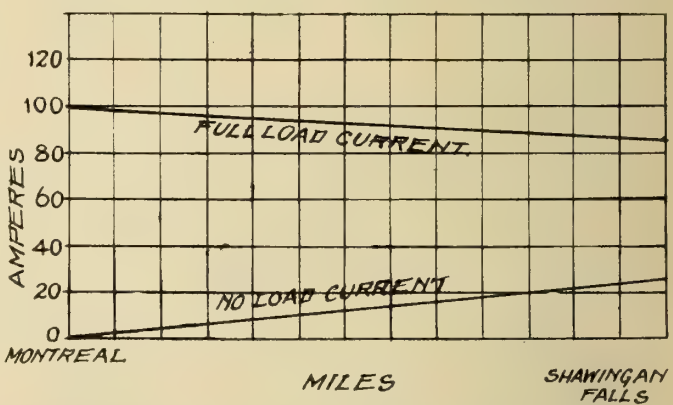
1,300 lbs. applied vertically at each of three insulators or ground wires—total 3,900 lbs.

1,300 lbs. applied vertically at all supports—total 10,400 lbs.

These towers are usually tested at the works of the maker, and it is interesting to note that the design has been perfected to such a point that the towers can be designed for exactly the predetermined load.

In making a specification for a tower such as that given above, the factor of safety is included in the loading, that is, the tower is designed so that if the loading should be more than that for which it is specified, the tower will fail.

The weights of the towers increase rapidly with the span.



Charging current curves, transmission lines 5 and 6

The table shows how the weights increase with increasing span with standard loading.

Span 300 ft.	4,100 lbs.
Span 400 ft.	4,350 lbs.
Span 500 ft.	4,700 lbs.
Span 600 ft.	5,400 lbs.
Span 700 ft.	6,400 lbs.
Span 800 ft.	7,500 lbs.

These figures are based upon a constant tension in the wires, that is to say the sag is increased by increasing the height of the tower, so as to maintain a constant tension as the span is increased.

The usual conditions, however, make the maximum stresses come when the wind is at right angles to the line and

the wires are covered with sleet. This load evidently increases as the span.

The table below is based upon a constant tension in the wires, and the increased weight of the tower is assumed to only take care of the increased height necessary to provide the tension sag.

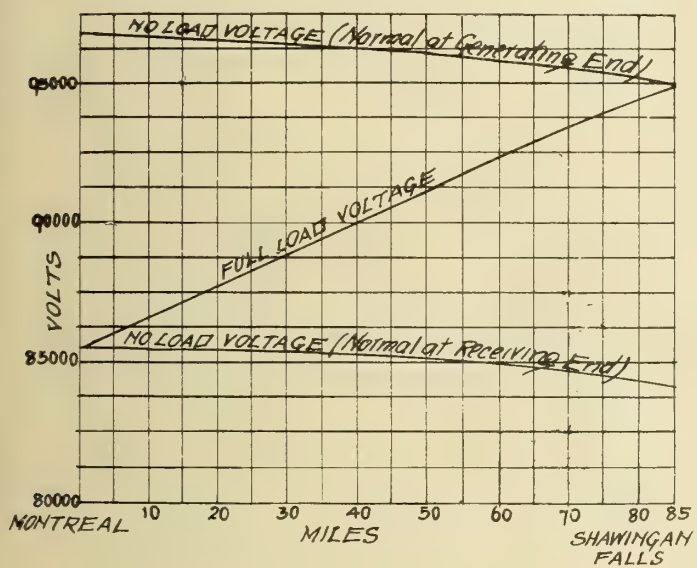
This is fairly true for such a small difference of span as that indicated, but in general, as stated above, the weight of the tower increases much faster than the table indicates.

Although there is no formula in the writer's opinion which shows the variation of the weight of the tower with the increasing span, still it is easy to make calculations for each case, and a table can readily be prepared, showing the weight of towers properly designed to take the stresses to which they will be subjected, and then a computation can be made to indicate the minimum weight of the steel required for the whole transmission line.

*Span in feet	450	520	550	600
Cost of Tower	$163	$188	$201	$238
Cost of Installation	42	42	42	42
Cost of Foundation	70	70	70	70
Totals	$275	$300	$313	$350
Cost per foot	.61	.576	.571	.582

*1910 Prices.

The cost of the towers is usually on a pound basis, and



Voltage curves, transmission lines 5 and 6

this steel costs today a little more than standard structural material.

There are various designs for transmission towers including what are know as the suspension tower, the anchor tower, and the flexible tower, but the difference in weight and cost is not extremely great, and unless the cost of steel of which the tower is constructed is excessive, due to difficulties of transportation, the choice of the type of tower is largely one of opinion.

The weights of the hydro-electric towers and the Shawinigan towers are very nearly the same, although the general design of the towers is quite different.

Foundations

There are two main types of foundations for steel towers.

One of these consists of an angle 6 in. x 6 in. bolted to each corner of the tower, and extending into the ground about 6 ft. On the bottom of this angle is placed a grill of bars or angles. The steel which is placed underground is usually coated with some special type of paint to prevent rusting or chemical action.

This type of foundation depends altogether upon the resistance of the earth which is filled in to the hole, the theory being that a cone having an angle of about 30 deg. can be assumed as representing the weight resting upon the grill.

The second type of foundation consists of a concrete pier, either plain or reinforced, containing a heavy foundation bolt to which each corner of the tower is attached. These concrete blocks are built in place by excavating the earth 6 ft. below the natural surface and bringing the tops of the piers to the proper grade. The piers are battered, and to a considerable extent the resistance of the earth is depended upon to hold the pier in place.

In very bad ground the steel angle footing has not proved successful, as the softening up of the earth above decreases the weight of the supporting earth and under high winds the footings are apt to be pulled out, and the tower tilted over. In good ground no difficulty is experienced with this type of footing, the only question being as to the life of the footing.

Sufficient experience has not yet been had in regard to the life of either the footings or the towers, to determine which is the proper design. In general, however, it may be stated, that the steel footings cost considerably less than the concrete.

There is a considerable advantage in the use of concrete footing during erection, as it is very difficult to put in proper template and grade, and keep the steel angle studs in place.

Owing to the uncertainty as to the action of the steel footings, both in regard to their life and their stability to withstand upward pressure under certain conditions of the soil above, the writer is strongly in favor of the use of concrete footings.

The following may be taken as the cost of a transmission line with conductors 250,000 c.m., and insulated for 100,000 volts.

Cost	Conductors	Insulators	Ground Wire	Towers	Foundations	otal
Per h.p.	$6.40	$2.50	$0.60	$8.90	$2.60	$210.00
Per Tower	248.00	97.00	24.00	347.00	102.00	818.00

Cost of Transmission Line, 100,000 Volts

Length of Line, 86 Miles—Number of Towers, 867—Average Span, 520 Feet

	Per Cent.
General survey	8.80
Excavation bases	2.16
Bases complete	6.1
Towers	24.0
Assembly of towers	2.95
Erection of towers	1.0
Insulators	7.9
Aluminium conductors, erected	19.6
Steel cable, erected	1.96
Telephone line complete	3.08
General office, engineering expense, tests, and inspection	2.46
Construction, plant, tools	2.86
Transportation of line material and tools	3.46
Camp equipment, supply transportation, etc., sheds, stores, office	8.32
Special construction, river, railway crossings, disconnecting switches	1.32
Freight	3.68

In the above figures are included taxes, interest, and insurance, equals 3.4 per cent. of the total.

The right-of-way where purchased in fee simple varies in cost from $25.00 per acre for barren or worthless lands to $250 per acre for well-cultivated farm lands, and to $2,000 or $3,000 per acre for lands near a large city. The total cost of the right-of- way is a large item and may be as high as 25 per cent. to 40 per cent. of the total cost of the construction.

If it is necessary to expropriate these lands the cost may greatly exceed the figures given above

Loading

For Eastern Canada and the North Eastern part of the United States, the loading to be used for the design of the towers is fairly well standardized, and is as follows:—

Maximum wind stress 25 lbs. per square foot flat surface corresponding to a wind velocity of 80 miles per hour.

The conductors are assumed to be cylinders, and the wind loads on these are taken as half the load on the corresponding flat surface. Half of the area of the towers is assumed to be subject to the wind load.

The material is assumed to be stressed to the elastic limit under the loads taken, and these loads are supposed to be the worst possible conditions which can arise, that is to say, the factor of safety is taken into consideration in estimating the loads.

The ice or sleet load is assumed to be due to one-half inch around the conductor, and the weight of this sleet is taken as 55 pounds per cubic foot.

The temperature range varies with the location of the line, but it is customary to take for this, about minus 40 deg. F. as a minimum and plus 120 deg. F. as a maximum.

General Design

In laying out a new transmission line the designer should give careful attention to several features which decide the route.

1st. The accessibility of the line from existing railroads or highways.

2nd. The physical characteristics of the country.

It is very undesirable for a line to be carried over the crest of hills on account of the increased liability of trouble from lightning at these points.

Forests affect the cost of transmission lines. It is desirable to cut through a forest an opening 600 ft. wide to make room for two tower lines which would be spaced about 50 ft. apart in the centre of this opening. In high winds there is a very large amount of flying material in the air, and small branches of trees are very apt to be blown against the wires. There is also the more serious danger of forest fires which would destroy the transmission line completely, and render the repairs difficult and lengthy.

In laying out a new line it is important that accurate information and maps be obtained showing the exact profiles of the proposed route, and giving sufficient information so that the location of every tower can be predetermined and profiles drawn up to show the position of the conductors both at minimum and maximum sags, for every span throughout the line.

LEGAL OR PUBLIC ASPECTS OF THE PROBLEM

The status of transmission line enterprise at the present time is not as well defined in Canada and the United States as is desirable.

Some of the states such as Massachusetts and New York have enacted very stringent laws giving public utility commissions jurisdiction over all public utilities.

In Canada, the laws in the different provinces vary considerably, the province of Ontario having taken quite a different stand from the control of private corporations by commission. Instead of this the province of Ontario has developed on extensive state owned system,—and is administering this by selling power purchased from a private company to various public municipal corporations.

In addition, Ontario has given this commission very large powers of control over other public service corporations within the province.

In Canada transmission companies can be incorporated either by Federal or Provincial Statutes. Whatever rights the transmission companies may have, such as the right of eminent domain, are granted in their charters, and the result is that the different charters granted to different companies vary widely as to the rights given.

There seems to be a general tendency throughout Canada and the United States to decrease the powers granted to these companies, particularly when such powers interfere with municipal by-laws.

A new enactment almost always provides that special permission must be obtained from municipalities before poles and wires can be erected in the streets.

Owing to the danger which would exist to overhead systems in the event of failure in a high tension wire, it is a well established custom that high tension systems for the distribution of power throughout the district, using voltages of over 15,000 volts, should not be erected on the streets of any thickly populated city or town.

This is not to be understood as stating that it is not customary to bring high voltages into cities when these high voltages are used for a main line ending at a substation. Special care must be taken in the design of pole or tower lines carrying such high voltages in cities and (in general) long spans cannot be used on account of the swinging of the wires.

There is a large amount of missionary work to be done still in the education and instruction of the general public, with regard to transmission lines.

Largely through ignorance, a considerable amount of interference takes place constantly with these systems. Young men and boys who would not think of tampering with the operation of a railway system, do not hesitate to interfere with the delivery of power.. Such interference is almost always based upon ignorance, and in many cases results in injury to the person tampering with the line. As engineers, it is our duty to see that more information is made public, as to the serious effect on industry in general, of such interference with transmission lines, and to bring it to the attention of the authorities, such as teachers in the schools, and other instructors of the public, so that the facts regarding the importance of not interfering with the service on transmission lines, may be appreciated.

Another important matter is to emphasize the cost of these systems. There seems to be a general impression that a transmission system as such is a small part of the total development, and if power can be generated even at a high cost, that this power can be transmitted long distances and sold at a profit.

It need hardly be pointed out that the facts are quite opposite to this. The present cost of these lines when constructed as outlined in this paper varies from $40.00 per h.p. for a 100 mile line delivering 25,000 h.p. up to a very much higher amount for smaller propositions.

Thus it can be well understood that the transmission line may cost as much per horse-power, as the whole hydraulic development.

In figuring the cost of the delivered power, where the market is at a considerable distance from the source of power, it is therefore very necessary to realize that the cheap source of power does not in itself indicate that the proposition can compete economically with other power plants located closer to the source of the market, or with steam plants located right at the market.

Kerry & Chace, Limited, has been incorporated to carry on operations as consulting, constructing and operating engineers. Head office Toronto.

United States President Wilson is said to have in course of preparation plans for the acquisition of the telegraph and telephone systems of the United States, these to be operated as a government enterprise.

Telephones in Forestry Work

Within the past year remarkable advances have been made in forestry matters in British Columbia, the records returned to the forestry branch at Victoria indicating a distinct and permanent turn for the better. This applies in particular to the Coast district of the province where, under the direction of Mr. G. D. McKay, provincial timber inspector and chief fire warden, noteworthy advances have been made in providing methods whereby the news of an outbreak of fire can be acquired with the least possible delay. In addition to the construction of numerous trails, look-out stations and other facilities to ensure a minimum of delay in bringing assistance to any points where a bush fire may be observed, the work of the provincial branch is being further expedited by the establishment of a complete system of telephone communication, the reports of the various forestry experts in the earlier part of the present year urging the necessity for increasing the efficiency in this direction.

At the present time the only lines in use by the department are the B. C. Telephone system which is within easy reach of every fire warden in the Fraser Valley District, and the Dominion government telephone and telegraph line extending along the Coast from Vancouver to Lund, a distance of about 100 miles, and westward from the latter point to Campbell River on Vancouver Island by way of Heriot Bay on Valdez Island, an additional 40 miles. Communication with wardens stationed at points further north is effected by means of wireless to Alert Bay, where the ranger for that district makes his headquarters, a distance of about 222 miles from Vancouver.

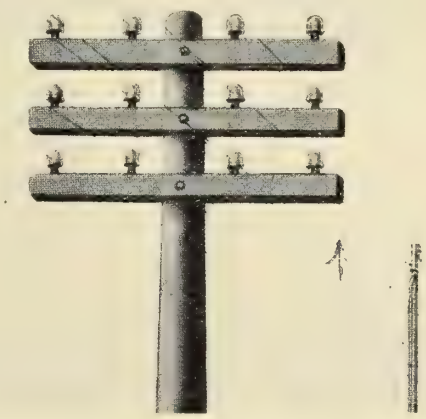
The telephone system which will be provided by the provincial government for the use of the forests branch consists of three distinct lines covering the operations of the fire fighting forces in the Coast district, with direct connection to headquarters at Vancouver and Victoria. One of these lines will follow the coast line on Vancouver Island from Campbell River to Alert Bay, a distance of 100 miles, with branch lines extending up the courses of the Salmon and Campbell Rivers for a considerable distance. After this route had been surveyed last spring by Mr. H. E. Elsden, telephone expert for the provincial government, it was learned that the Dominion authorities had already completed plans for the extension and as definite assurance has been forthcoming from Ottawa that the line will be built at an early date, the question of its construction has been left in the hands of the Dominion government.

The most important line to be constructed will extend from Heriot Bay on Valdez Island—where connection will be made with the Dominion government telephone system—to Shoal Bay on Thurlow Island, some 60 miles distant. This route was surveyed under the direction of Mr. Elsden last June, and it is expected that the construction of the line will be completed by November 1st. Extending through the largest logging district in the province, this line will provide communication with fully 100 settlers and upwards of 50 logging operators. Next year it is intended to push construction some thirty miles further to a point on Loughborough Inlet, a survey of this section being already completed. From Loughborough Inlet the route will eventually be extended by way of Roy Post office, Jackson Bay, to Glendale Cove near Tom Brown's Lake on Knight's Inlet, which will be its termination for the present. When completed this line will be about 150 miles in length, and will tap the logging operations of the Coast of the mainland from Heriot Bay north to Queen Charlotte Sound.

The third line contemplated will commence at Old Douglas on Harrison Lake, 65 miles east of Vancouver, connecting with the B. C. Telephone Company's system at that point, and extending along the route of the Pacific Great Eastern Railway to Pemberton Meadows, a distance of some 60 miles. This line will be erected at a very moderate cost, owing to the fact that for almost the entire distance it follows the old Cariboo wagon road, which is still in fair condition.

Railway Telephone Device

The value of the telephone in railway work for the handling of trains is now very generally recognized. In June, 1908, only a little over five years ago, the first train despatching circuit in Canada was installed by the Canadian Pacific Railway between Montreal and Farnham, a distance of 45 miles. Early in the present year telephone equipment on the main line of the British Columbia division was completed so that with the exception of one of the double track sections between Winnipeg and Fort William the trains on the whole main line of the C. P. R. from ocean to ocean and on



Telephone can be attached anywhere along the line

a large number of the branch lines are now operated by telephone on metallic circuits. In addition every railway of importance in Canada and the United States has at least part of its lines, where heavy traffic is handled, equipped with the telephone train despatching apparatus.

The telephone circuit also permits the use of emergency instruments on each train whereby at any time and at any place along the line, by bringing the train to a standstill, the conductor or any member of the crew may place himself in immediate communication with the dispatcher at head office. This device was invented by Mr. J. F. Richardson, superintendent of C. P. R. telegraphs for British Columbia and is shown ready for action in the accompanying reproduction. The device consists of a pair of hooks attached by means of a long pole to the two wires of the telephone circuit, these hooks being connected by two wires to the telephone instrument. The C. P. R. have over 2,000 trains equipped with this device and many other railways in Canada and the United States are installing them at the present time.

Have Increased Capacity

The Eugene F. Phillips Electrical Works, Limited, of Montreal, have added very largely to their capacity for making telephone cable by installing the entire equipment of the telephone cable department of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, New York. The plant was purchased by Eugene F. Phillips Electrical Works, Limited, and is now running in the extension to the Montreal company's works recently constructed at a cost of about $250,000. The company, who have been manufacturing telephone cable for many years, are now in a position to execute very extensive orders.

Electric Railways

New Twenty-two Mile Extension to the B. C. E. R. Lines on Vancouver Island, B. C.

Sir Richard McBride, Premier of British Columbia, recently "drove the last spike" of a new interurban extension of the electric railway system of the British Columbia Electric Railway Company, Limited, on Vancouver Island. The act was the final stroke in an undertaking which has been in progress for the past two years and on which over $1,000,000 has been expended.

The new extension of the B. C. Electric is located on the Saanich peninsula and was constructed with the idea of connecting the various districts of this section of the island with Victoria, the capital of the province. The line is about 22 miles in length and extends from Victoria almost directly north, passing through the centre of the Saanich district and terminating at Deep Bay situated at the northern end of the peninsula. On its course a short branch line has been constructed to Meadlands, a beautiful resort on Patricia Bay, a branch of the Saanich Gulf.

In planning the Saanich line the B. C. Electric looked somewhat into the future and secured several large tracts of land at eligible points which are being held for specific purposes. Near Patricia Bay the Meadlands estate was secured and at this point it is planned to create a modern suburban townsite of high standard, plans for the laying out of the place being now under consideration. The bay at this point is such as opens up great possibilities as a picnic and pleasure resort and developments along this line will also be undertaken. At the terminus of the line, Deep Bay, another beautiful pleasure resort is afforded and this point will be developed by the company as a model picnic ground.

Along the route of the line is also located the Dominion Agricultural Farm which was purchased a few years ago when the interurban line was planned. This tract has already been cleared and is partially under cultivation. Within a few years it will be brought to a high standard and conducted as an experimental farm where the resources of the district may be tested under trained supervision.

At Deep Bay facilities are provided for connection with the many fertile islands in the Gulf, all of which are now partially developed and devoted to agriculture. Promptly with the opening of the line regular launch service was inaugurated between Deep Bay and these islands and the produce from the points is now daily brought to Victoria over the new extension.

Industrial life is also to play a part in the development of the Saanich peninsula, as on it are located two large cement plants as well as numerous industries of lesser size. One of these cement plants, located at Bamberton Bay, was opened about the same time as the interurban line. The industrial possibilities along the extension may be judged when it is stated that this single plant involves an expenditure of $1,250,000, and that the daily output will be 2,000 barrels. Power for the operation of the plants is provided by the B. C. Electric.

All the above facts concerning the probable development of the Saanich peninsula and the advantages which residents of Victoria will derive from the line were pointed out at the banquet which was held in connection with the opening of the line. Premier McBride said that it was only a few years ago that he officiated at the opening of the 76-mile extension of the B. C. E. R. Co. through the South Fraser Valley, from Vancouver to Chilliwack. He expected that the Saanich line would do for Victoria and the Saanich peninsula all that the Fraser Valley line had in a few years done for Vancouver. Premier McBride also paid high tribute to the B. C. Electric for its work in developing the province, noting that the company had already invested over $40,000,000 in order to provide for the demands of the public for light and power and electric railways and was still planning large undertakings for the near future.

The company have anticipated the requirements of this new road and already have ample power in both hydro-electric and steam developments to take care of the increased demands. At Jordan River, where their main water power



Map showing B. C. E. R. Vancouver Island lines

is situated, 12,000 h.p. is available, with a second 12,000 installation almost completed. At Goldstream there is also the early development of 3,000 h.p. The steam plants consist of 1,500 h.p. capacity situated in Victoria City, and 6,000 h.p. recently installed at Brentwood Bay, a point on the west coast of the Saanich Peninsula, which is at about the middle point for the new railway line.

The hydro-electric plants and the Brentwood steam plant are all interconnected, so that a supply of power for the operation of the road is assured in any emergency. The accompanying map shows the location of the power plants. The map also shows, in a general way, the complete railway system in Victoria city and the Saanich peninsula. The new line is now being operated at 550-600 volts d.c., but arrangements are being made for its operation at 1200 volts d.c.

The passenger cars provided for the line are 50 feet over all and are equipped with four 75 h.p. motors. Provision

is made for train operation, all cars being provided with type M multiple unit control. In addition to a full complement of passenger cars the line is provided with baggage and express cars and locomotives and box and flats for freight traffic.

Twenty-two stopping points are now provided along the



B.C.E.R. Steam plant, Brentwood Bay

line at each of which a neat shelter has been erected. The regular schedule from Victoria to Deep Bay calls for operation in 1 hour and 15 minutes. Three car trains are used for the run, the schedule calling for trains in each direction every three hours from 6.40 a.m. until about 11 p.m. The location of stations and running schedule are at present



B.C.E.R. officials on Vancouver Island. From left to right —A. King, solicitor; E. H. Adams, accountant; H. Gibson, supt. Victoria lines; G. Hughes, resident engineer; A. T. Goward, local manager; S. J. Halls, supt. light and power; F. D. Picken, supt. Saanich line; G. M. Tripp, engineering supt.; A. Richardson, stores accountant; F. M. Hewlings, supt. gas company.

only temporary and will probably be altered to suit traffic conditions which may develop. The passenger traffic over the line is based on a maximum of three cents per mile.

In connection with the opening of the Saanich line the B. C. Electric issued a souvenir which noted the growth of the company's investment and business on Vancouver Island as follows:

	1890	1903	1913
Capital expenditure		$900,000	$7,000,000
Miles of track	8	12	60⅛
Number of cars	4	16	55
Horse power utilized	350	2700	23,000
Horse power under present development			13,000
Number of employees	50	120	820
Office staff	2	15	102
Miles of lighting circuit		65	150
Miles of gas mains		10¼	45

Regular traffic on the Saanich line was started the day after the official opening and results equal to the expectation of the management have already developed.

The line was constructed under the direction of general manager R. H. Sperling, assisted by chief engineer G. R. G. Conway. In the supervision of the work the general management of the company had the hearty co-operation of its Victoria staff which includes local manager A. T. Goward, general superintendent G. M. Tripp, resident engineer G. Hughes and F. D. Picken, who will be superintendent of the branch.

M. & S. C. Extensions

The Montreal and Southern Counties Railway Company are pushing ahead with their extensions, and have let the contract for building the concrete substructure of a large bridge—four piers and two abutments—to be erected over the Yamaska River at St. Cesaire, P.Q., to Messrs. Ross & McComb. The same firm are constructing the line through the town of Granby, P.Q., a distance of 6,300 feet. The extension from Richelieu to Marieville was opened on Saturday, September 27, with a certain amount of ceremony, and the company are now engaged in building the extension from Marieville to St. Cesaire, and hope to have it completed by the end of the year. Operations have been commenced on a concrete sub-station at Rougemont, and this will be equipped with a 300 kw. motor generator set, one bank of transformers, high and low tension switchboards, lightning arresters and switching apparatus. About 12 new cars are to be purchased. These will be 57 feet long, as against 50 feet for the present cars, and are designed to have through platforms. They will be of the multiple unit single control type. Toilet accommodation will be provided. Baggage cars are also to be purchased

New Type Trailer

Major J. E. Hutchison, general manager of the Montreal Tramways Company, has designed a special type of trailer car which is to be used on the St. Catherine Street service. Twenty-five trailers are under construction, and Montreal will thus add a new feature to her transportation facilities. The idea of utilizing old cars has been rejected, and Major Hutchison has planned a car which he believes will overcome the objections to the usual form of trailer. The new type will couple up close to the motor car, an automatic coupler and three-way connector being provided for breaking, lighting, heating, and automatic door signal. A special appliance will close the doors and fold in the steps of the trailer before it will be possible for the cars to start. The leading car will have a seating capacity of 44, and the trailer will accommodate an additional 54 passengers. The entrance to the cars will be at the rear of the motor vehicle and the front of the trailer. The exits will be at the front of the motor car and immediately behind the entrance in the front end of the trailer. There will be neither entrance nor exit at the rear of the trailer. This design will make it possible for one conductor to operate both motor and trailer cars.

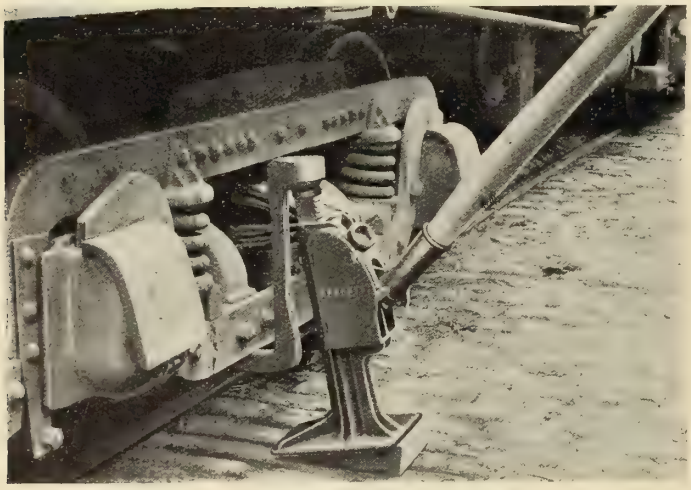
An Emergency Car Jack

The accompanying illustrations have reference to an emergency car jack being manufactured by the Duff Manufacturing Company of Pittsburgh. Fig. 2 shows the jack in operation, replacing a derailed car on the track. This emergency car jack is often referred to in the United States



Emergency car jack

as the "Bay State" jack, as all the street railway systems in Massachusetts have been equipped with it, every car carrying a jack for use in case of derailment. Among other street railway systems that have adopted this equipment for every car in operation on their line may be mentioned the Harris-



Showing jack in operation

burg, Pa.; all interurban cars in Pittsburgh; all cars of the Scioto Valley Traction Company, Columbus, Ohio, and the wrecking cars on the electric railways in New York city, Pittsburgh and many other cities.

Calgary Municipal Annual Report

Mr. T. H. McCauley, superintendent of Calgary's municipal railway system has just issued his annual report for the year ending June 30th, 1913. During that time the gross revenue from operation amounted to $704,053, of which 71.31 per cent. was eaten up in operating expenses. The gross earnings per car mile figured out at 26.585 cents and the operating expenses at 18.96 cents. The average fare, revenue passengers only, works out at 4.008 cents, but including all passengers and transfers was 3.022 cents. The total mileage, single track, now amounts to 71 miles. The rolling stock consists of 70 motor cars, 6 trailers and 12 miscellaneous; 8 cars, 46 ft. type, are now on order. The cost of construction and equipment per mile of road owned is placed at $28,210.

Street Railway Extensions in St. John

It is expected that within two months the St. John, N.B., Railway Company will have its line extended for a mile along the Marsh Road and thence to Kane's Corner and in again, making a circuit and giving a service which will be of great benefit in building up the section traversed by the line. The city council and the company have come to terms, and the work of construction will be proceeded with immediately, as the company have a supply of rails and ties sufficiently large to complete this important extension of their line.

Sherbrooke Railway and Power

During the financial year which ended on June 30th last the gross earnings of the Sherbrooke Railway and Power Company increased $34,058, and the net $14,978, and after payment of all charges the sum of $3,216 is carried forward to the credit of profit and loss. Two large concerns, during the summer, entered into contracts to take power, and these are estimated to bring in an annual revenue of $21,500. The company's lighting system has been extended to four villages, while there has been an increase in the lighting and power business at Lennoxville, Stanstead, Beebe Plains, Derby Line and Derby Centre. The increase in net revenue last year was principally due to the lighting and power branches of the company's system.

Miscellaneous

A vote will be taken during October on the question of spending $700,000 on the electrification of the London & Port Stanley Railway.

Application is being made to the Ontario legislature for the incorporation of the London, Grand Bend and Stratford Railway Company.

The fourth annual convention of the Electric Vehicle Association will be held at Hotel La Salle, Chicago, on October 27 and 28. A program of special value to all interested in electric vehicles will be presented.

Mr. J. L. Englehart, chairman of the T. & N. O. Railway commission, is credited with the statement that the Kerr Lake branch of that railway may be electrified next year, in which case it would be operated as a section of the present Nipissing Ceneral system.

A certain German street car line operating between cities in Rhenish, Prussia, charges only about half the regular passenger rates to those who stand. The fare from Elberfeld to Werden, a distance of about 10 miles, is 30 cents for those having seats and 17 cents for those standing. The round trip rate costs 50 cents if the passenger has a seat, while those who remain standing pay only 25 cents. The trip from Elberfeld to Werden takes 1 hour and 50 minutes.

A deputation of members of the Ottawa City Council recently waited on Mr. Thomas Ahearn, president of the Ottawa Electric Railway Company, to ask for the extension of the workmen's tickets, which now sell at eight for 25 cents and may be used from 6 to 7.30 o'clock in the morning and from 5 to 6.30 in the evening. The deputation requested that the time for the tickets be extended until eight o'clock in the morning and made good from 12 to 1 o'clock at noon time. Mr. Ahearn replied to the deputation that the company would be unable to grant the request as there is no profit being made on this class of tickets at present.

The Dealer and Contractor

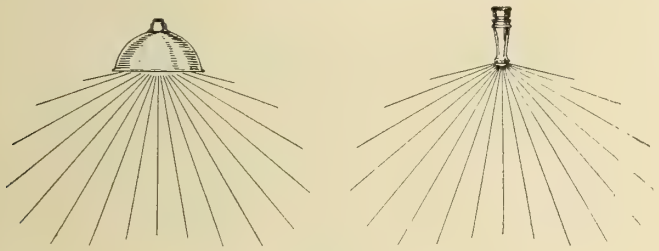
Lighting of Mills and Factories

(Contributed)

No factory executive will deny that good artificial illumination is necessary to the efficient operation of an industrial plant. The mass of convincing evidence to this effect which has been collected by production and efficiency engineers, by cost analyses and even by those practical factory managers who cling to the rule-of-thumb, leaves no defense for inadequate lighting. Good illumination is cheap; poor illumination is not only expensive, it is wasteful and inexcusably extravagant.

The essential problems in the lighting of mills and factories are three: first, to provide sufficient illumination and at the same time to protect the eyes of operatives; second, to provide for efficient distribution of light both by proper placement of units and by selection of units according to their reflecting characteristics; third, to arrive at an evaluation of all factors of cost and value so that a true cost comparison may be made as between different types of equipment.

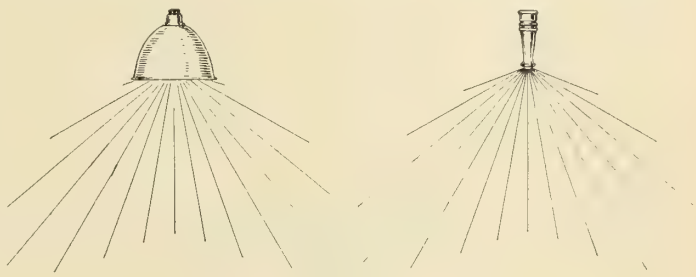
The protection of the eyes of operatives is of first im-



Broad Distribution

portance. Everyone has experienced the inconvenience, sometimes amounting to actual pain, of passing from a dimly lighted room into dazzling sunlight, or of trying to see past a brilliant light, as when driving on a dark night into the glare of an oncoming auto headlight. These are extreme cases of the very kind of eye-strain to which workmen are exposed in the large majority of industrial plants. Continued eye-strain brings on a condition of abnormal vision. This condition usually does not cause an immediate permanent injury to the eyesight, but it is during the temporary period of abnormal vision that spoilage, errors, and accidents are most likely to occur. Proper eye protection requires a system of lighting which eliminates brilliant points of light within the range of ordinary vision, and one that avoids violent contrasts of light and shadow. This is best accomplished by the use of mazda lamps equipped with extensive or intensive deep bowl reflectors. These reflectors have been designed so that they are of sufficient depth to cut off direct glare, and so that they give distribution of light such that they may be spaced to provide an illumination of high intensity, and excellent uniformity when hung well above the range of ordinary vision.

The shallow dome, and shallow bowl distributing shapes which give a broad distribution of light are recommended only for the lighting of warehouses and similar spaces where the question of eye protection is of little importance. The effect of the shallow reflector on the workmen's eyes, as compared to the deep bowl is illustrated in the accompanying diagrams. It is a common error to select shallow shaped

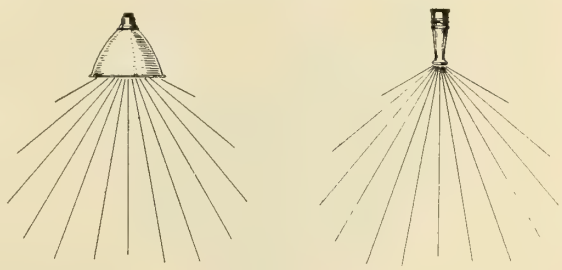


Extensive Distribution

reflectors giving the broad distributing distribution on the supposition that they will give a uniform illumination when spaced at greater distances apart than the extensive and intensive bowls. Distributing reflectors throw some light to a greater distance than extensive reectors but not in sufficient quantity to provide uniform illumination when spaced at greater distances apart.

With the question of eye protection settled, the selection of reflectors should be made because of the distribution of light which they will deliver and not because they are flat, shallow bowl or dome-shaped.

At first glance it may appear to the factory executive that a discussion of light distribution is a highly technical subject, but it is not at all difficult when one compares the reflector with an adjustable hose nozzle. The diagrams reproduced herewith show that just as the nozzle can be adjusted to throw the water in a stream varying from a fine spray which covers a broad area with a small amount of water per square foot, so can the reflector, when properly designed, control the light, distributing it widely at com-



Intensive Distribution

paratively low intensity or focussing it into a concentrated stream of great brilliance.

It is commonly understood that the distribution of light given by a reflector depends upon the reflector's shape. While this is true in a limited sense, it is also true that two reflectors of widely different shapes may give almost identical light distribution. For example, the shallow dome dis-

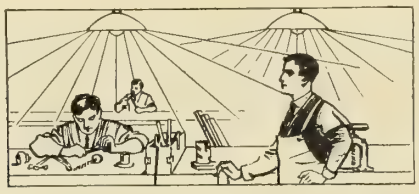
tributing type reflector and the shallow bowl distributing type reflector give exactly the same distribution of light although the two shapes are widely different. The reason for the difference in shape is found in the remarkable dissimilarity in the reflecting characteristics of "cleanezy" aluminium and porcelain enamel with which the two shapes are finished. From this it must be obvious that the distribution and



Deep bowl reflector protects the eyes.

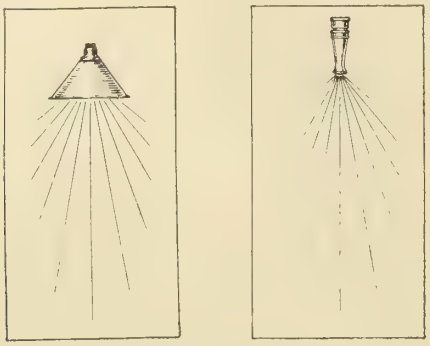
not the shape is the first consideration in the purchase of reflectors, and that of two reflectors having approximately the same distribution curves, that one is the more desirable which more nearly meets the other requirements of the installation.

And this is true practically without regard to the cost of either reflector. The question of cost of lighting equipment is one which is too often decided from the standpoint of the purchasing agent rather than the broad vision of the operating executive. A proper lighting unit is just as necessary to the efficient, continuous operation of a machine as is proper lubrication. No factory manager would employ unsuitable lubricating oil for the sake of a slight economy, yet we



Not suited for close eye work.

frequently find unsuitable reflectors selected solely upon a price argument. A skilled operative may be paid from 25 to 60 cents an hour, and in this latitude works probably not less than 300 hours by artificial light, his wages amounting to $75 to $180 per year. Weigh either sum against the cost of the lighting equipment which may either facilitate or retard that workman's labor, and the relative insignificance of the reflector cost is apparent. Or consider it against the value of the work performed. In operations where the pro-



Focusing distribution.

duct is nearing completion, a very slight error may destroy the result of many hours of labor. Under such conditions, any reasonable price which may be invested in lighting equipment which will eliminate eye-strain and at the same time provide ample illumination may properly be considered as insurance upon work in process.

A summary of these remarks will show:—

(a) That avoidance of eye-strain and provision of ample illumination are of equal importance in the lighting installation:

(b) That in selecting a reflector for a given service, distribution of light and eye-protection are primary, and the shape is secondary; and,

(c) That the price per reflector is negligible as compared with the value of the permanent service it renders, and should be disregarded except in comparing reflectors which are equally desirable in other respects.

The Fallacy of the One-Light Unit—The Customer's View Point

(Contributed)

Better distribution of light by means of a one-light ceiling unit carries no weight as an argument, for the additional expense of the multi-circuit wiring more than offsets any apparent benefit. Efficient light distribution from an arm type fixture is merely a matter of selecting the scientific reflector best suited to the requirements.

Grouped lights on a fixture certainly tend toward economical operation when the pendant switch is used, permitting of the control of any of the lights on the unit. With the switch made accessible this economy proves a fact. Here is economy in operation to which must be added the saving not only in wiring, but also in fixture installation. The use of the large size, one-light lighting units must in practice call for increase maintenance cost, and at the same time prove troublesome in the case of a burn-out, which leaves a large area without illumination. Distributing the candle power developed over a number of smaller lamps safeguards against these conditions and permits of working lamps up to their full efficiency without the extreme high cost for replacement prevailing in the large type lamps. Original installations of the 250 and 500 watt lamps are frequently changed to smaller size without any change being made in reflectors, holders, etc., thus robbing the entire installation of any suggestion of efficiency or science. There is an abundance of this evidence against the larger types in everyday practice. It is generally acknowledged today that the lighting fixtures are usually the center of the decorative scheme in a room's appointments. How much greater freedom the artist finds in designing a multi-light unit, but how restricted are his efforts in the case of the one-light types.

Every installation of fixtures made that represents better ideals in lighting is an advertising asset of lasting value to the dealer and contractor, as well as to the central station and the community. Every installation that does not, is a set-back in revenue and a reflection upon the splendid possibilities of the tungsten lamp and those who improperly install them.

Five convincing reasons can be advanced for hanging group fixtures high:—

First—The source of light is removed from the direct range of vision.

Second—A better distribution is obtained within the candle power limits of the lamp.

Third—The space to be lighted presents a roomier appearance by reason of the fixtures being higher up.

Fourth—The danger of the lamp and reflector being struck by a person passing beneath them is eliminated.

Fifth—None of the light from the lamp is wasted by being absorbed at the floor.

Your customer may object or flatly refuse to consider your suggestion. Here is where your opportunity comes in for exercising your talents and knowledge gained from a close study of the business, for, by a logical presentation of the facts your customer is bound to see the advantage of a proper installation, even though this approval may not come until the work is done. In this you are building for yourself and your own reputation for satisfactory work.

Series Mazda Street Lighting

The use of mazda lamps for street lighting in residential districts is recognized as being particularly desirable since with any lighting source the intensity of illumination

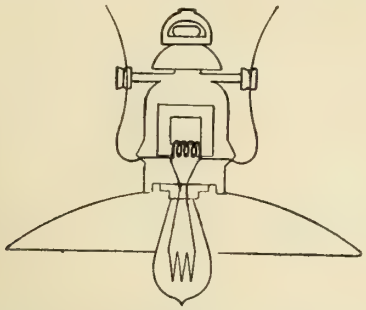


Fig. 1

is proportional to the square of the distance from the lighting source. Hence if the distance between the lamps is greater, for example twice as great, the lamps must have four times the candle power and consequently a mile of street will require twice as much energy. This is all the more necessary on streets where there are trees, as in this case arc lights, which of necessity have to be placed high up, lose much of their value.

For mazda street lighting the lamps are preferably operated in series, the same current passing from the source through all the lamps and back to the source. In the ma-

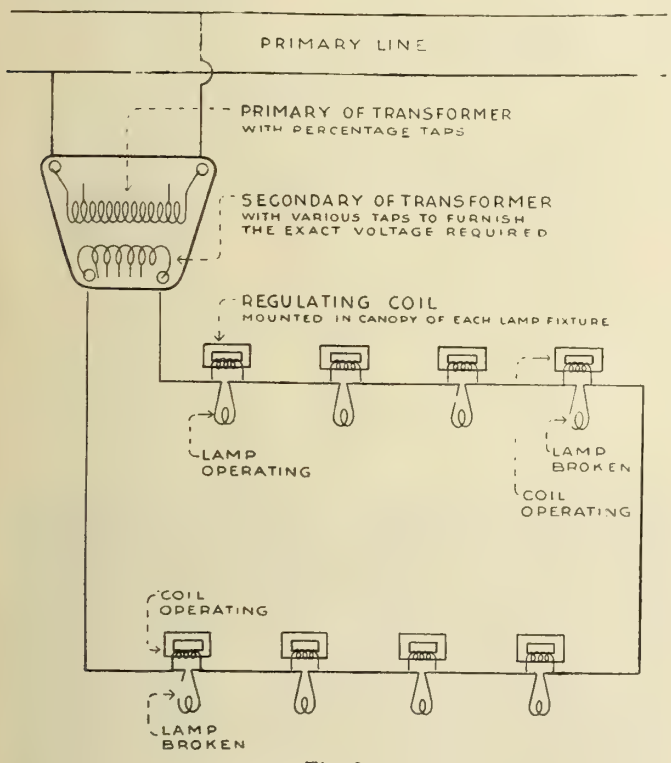


Fig. 2

jority of systems constant current regulators are provided in the generating station which further require panel-boards and auxiliary apparatus. In addition to the cost of equipment being considerably more, station space has to be provided and an attendant is required to watch the regulator. The efficiency and power factor of such a system is also low, figures for quarter-load showing often not greater than 23 per cent.

The Pittsburgh Transformer Company have devised a new scheme which does away with the more complicated apparatus. Around each lamp a regulating coil is connected. This coil has a reactance practically equivalent to the resistance of the lamp film so that when the lamp is "out" the coil automatically takes it place. The cutting in or out of the coil is of inductive action and is therefore accomplished without any moving parts. The equipment of the lamp unit is shown in diagram in Fig. and Fig. 2 represents the plan of operation of a small system.

To supply the voltage necessary for lamps operating in series a simple constant potential transformer is furnished, connected to the primary lines, and the secondary winding is designed for a wide range of voltage. This voltage arrangement allows lamps to be added to or taken from the system and is capable of adjustment through about thirty per cent.

The regulation of this system can be considered as being practically perfect. Constant current is provided under all normal conditions and lamps up to 30 per cent. may be out without appreciably affecting the regulation. With a greater number of outages than 30 per cent. the only effect is a gradual reduction in the current strength which constitutes a very necessary protection in case of accident.

A New Lamp Design

The arrangement of the filament in ordinary metal wire lamps is very unfavorable from the point of view of illumination distribution as is very clearly demonstrated in the

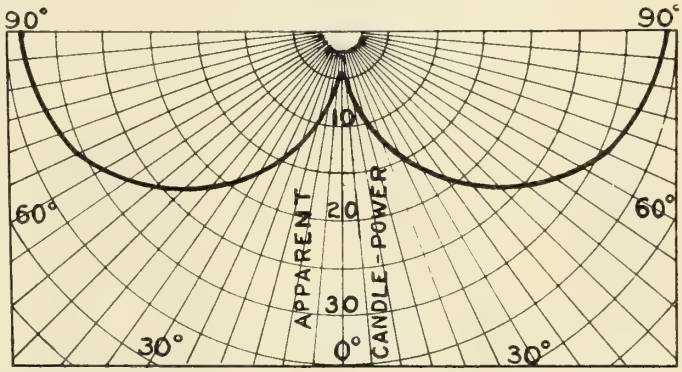


Fig. 1

light radiation curve in Fig. 1. A 32 candle power metal wire lamp of the usual shape only radiates 5.1 standard candle power downwards (in the direction of the lamp axis), the bulk of the light being given laterally. As many chandeliers and other illuminating agents burn with the tip hang-



Fig. 2

ing downwards, this irregularity in the distribution of light naturally makes itself unpleasantly felt. It is true that this can be, to a great extent remedied by the use of suitable reflectors, but it must be remembered that losses in the illuminating power occur at every reflection, and that the adop-

tion of reflectors is vetoed by many illuminating agents on aesthetic grounds.

Though the manufacture of metal wire lamps has reached a high state of perfection, there is no reason to retain the forms hitherto in general use, and the Philips Metal Gluhlampenfabrik A.G., Eindhoven (Holland), have taken up the construction of a new type of lamp, "the Projector," in which the filaments are so arranged that the strength of light is almost uniform in all directions. The filaments of the projector lamp do not run parallel on the filament support, but lie stretched in a conical surface. Figs. 2 and 3 show a 32-candle power projector lamp and its light radiation curve. A comparison with Fig. 1 will show at once that this is a very actual improvement; the effective illumination is many times greater than that on an ordinary metal wire lamp, and the strength of light remains the same whe-

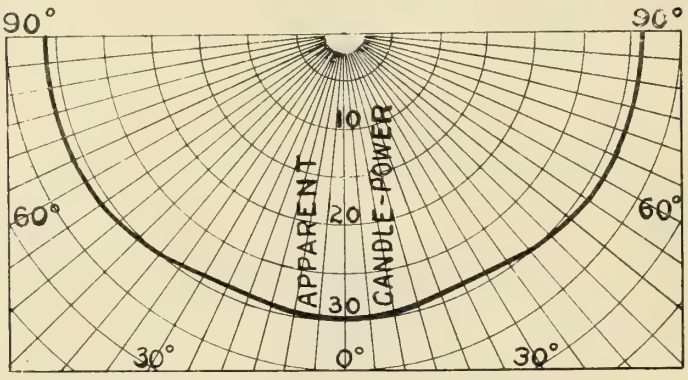


Fig. 3

ther the lamp burns in a vertical, horizontal or inclined position.

P. & S. Receptacles

The accompanying illustrations represent the two receptacles of Pass & Seymour, Inc., primarily intended for



use on wood moulding but which have been changed so that they may also be used on pipe taplets.

Good Advertising

The Toronto Hydro-electric System have made a specialty of window advertising which is doing much to educate the passer-by regarding the uses of electric light and power. During the last week of September one of their windows has been given over to a demonstration of the relative merits of different systems of controlling the lighting source, the idea being to show that it is not so much the quantity of light used as the proper distribution of the light which makes for good illumination.

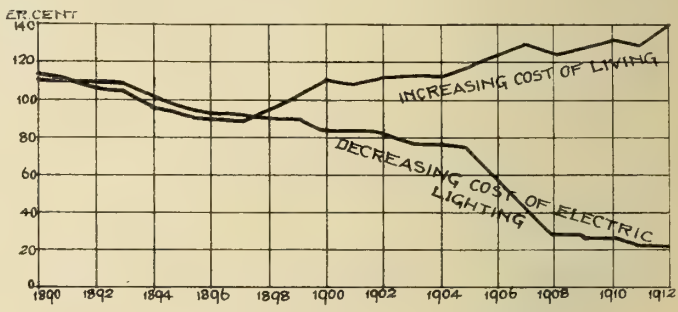
The entire window, measuring 21 ft. x 10 ft., was turned into a demonstrating laboratory, the window was curtained up the front, over the top and down the back to the height of some 2 or 3 ft. above the ordinary observer on the street; the ends were also carefully curtained off. In this way no light entered the window from outside except through a number of small peep holes arranged at various heights to accommodate the different observers.

The enclosure was divided at the back into six booths or stalls about 30 inches square. These six booths were grouped in pairs, so as to show three comparative tests. The lamps used throughout were Sunbeam mazda 60 watt clear globe, 115 volt type. No. 1 showed comparative results with one lamp enclosed in a number 7507 Holophane Realite and one lamp enclosed in a 6-inch roughed inside cut star ball—very much in favor of the former. Test number 2 compared seven bare 60 watt clear lamps bunched together with one small lamp mounted with a 8300 Holophane reflector. Even in this extreme case the illumination of cards placed on the floor under the lamps was considerably greater in the case of the single unit. Of course, the general illumination was better with the 7 units.

Test number 3 was a comparison between the ordinary white glass reflector and a Holophane scientific prismatic reflector both manufactured and recommended for 60 watt lamps.

Small cards called attention to each test and to the value of a correct system of illumination. One of the cards emphasized the aim of the demonstration with the words "It is not the amount of current you consume but the results you obtain from its use that interests the Hydro." The various types of globes and reflectors used in the demonstration were kindly supplied for the occasion by The Holophane Company.

During the same week the north window of the store was decorated with a huge chart some 20 ft. in length and



Showing marked increase in cost of electricity.

6 or 7 ft. high, demonstrating by two relative curves the fact that the average cost of living has greatly increased during the last few years while the cost of electric current has been tremendously reduced. This demonstration was further supplemented by a number of types of illuminating units which have been used during the last fifty years starting with the tallow candle, followed by the dirty oil lamp, then gas burners and carbon lamps and so on up to the latest type of tungstens.

Ontario Municipal Electrical Association

At a recent meeting of the Ontario Municipal Electrical Association held in the City Hall, Toronto, the following resolution was passed unanimously:—"In view of the comprehensive schemes outlined by the Dominion Government for the creation and improvement of waterways in connection with the St. Lawrence River, Welland Canal, French River, Sault Ste. Marie, Trent, Ottawa and others, involving a large expenditure of public money, and in view of the extensive power developments which are possible in consequence thereof, also in view of the rapidly increasing power requirements of the province, be it resolved that this association request the Dominion Government to put all such water powers under the jurisdiction of the Hydro-electric Power Commission of Ontario, to be developed by them for the use of the municipalities of the province for the benefit of the people."

A by-law is being submitted in Fort Frances authorizing the expenditure of $10,000 on an electric light and power plant.

New Consolidated Tungstolier

The new consolidated Tungstolier line which has just been introduced, is to a certain extent quite similar to the Tungstolier Company's folding line—which has made a name for itself among contractors, dealers and central stations



4-light round tubing "Consolidated."

from coast to coast. While the consolidated line does not "fold," it is designed in such a way that it comes all wired and two minutes makes a consolidated Tungstolier ready for installation. Herewith is shown cut of a four-light round tubing consolidated Tungstolier. The "no iron pipe" policy is carried out in the consolidated line as was the same feature in the folding line.

Decorative Lamp Designs

A number of very attractive designs have been added recently to the lines of glassware manufactured by the Mac-Beth-Evans Glass Company, two of which are shown herewith. These are specially designed for use in living rooms



Both efficient and decorative

or libraries in that a good amount of general illumination is combined with a highly decorative effect. The lamps shown are manufactured in different colors to correspond with the desired general scheme of decoration of the room.

The Dirt-less Workman

A valuable little booklet with the above title is being distributed by Mr. G. J. Beattie, electrical contractor, 72 Victoria Street, and secretary of the Electrical Contractors' Association of Toronto. The little booklet does not dwell so much on the value of electricity when it is once installed, although these advantages are pointed out, but emphasis is laid upon the fact that the work of installing electric wiring, outlets or fixtures in the home does not carry the same objections as the installation of plumbing or decorations of various kinds. Electrical operations can be carried on without inconveniencing the occupants of the home or destroying their comforts in the meantime, and a number of hints are given in this little booklet as to how these results are being accomplished by successful workmen. This booklet should go a long way toward disabusing the mind of the average householder of the idea that the entrance of electrical workmen into the home means either inconvenience to himself or disturbance to any part of his household property. The electrical worker with average caution has no excuse for being anything other than a dirt-less worker.

Metal Mouldings

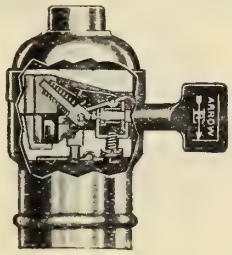
The National Metal Moulding Company have issued a new bulletin describing various of their products. These include metal moldings and fittings of various types, some of which are shown in the accompanying illustrations. Other



products of this company include snap switches, switch boxes and bases, cover plates, couplings, bushings, clamps, etc.

660 Watt Key Socket

The Arrow Electric Company, Hartford, Conn., have placed on the market a 660-watt key socket, with quick-make-and-break mechanism. The accompanying illustration shows



Arrow-E.

a sectional view of the socket, illustrating the mechanism. The rapid development of current-consuming devices has brought about the need of a socket with a greater capacity than the ordinary key socket, and it is to fill this need that the new socket has been designed.

The Elkins Glass Company

The Elkins Glass Company have developed a type of glassware which is claimed to approach very nearly to the totally indirect system of lighting. The finish on the inner side of the glass is such that it reflects practically all the light shed upon it, allowing only sufficient to pass into the glassware to produce a pleasing effect when observed from below. A very ingenious type of holder has been devised



Typical Vesta Glass Bowl

for this glassware each of the three or four holders used on any unit being a combination of a bowl-holder and a lamp-holder. In this way the conducting wires pass down the fixture chains and direct to the lamp so that there is no necessity for a drop cord or other central suspension for holding the lamps in place. The accompanying illustration shows one of their "Vesta" glass bowls for semi-indirect lighting.

Handsome Lamps

The Pittsburgh Lamp, Brass & Glass Company have recently evolved some lamps of very handsome design, two of which are shown herewith. Fig. 1 is known as the bungalow lamp and has been specially designed for the jewelry trade as giving ample illumination at the point required and adding at the same time, on account of the decorative design, to the attractiveness of the store. This bungalow lamp



Fig. 1—Bungalow Lamp

is a two-piece fixture, being composed of a heavy metal base on which the glass dome rests. There are no screws necessary to hold the dome in place and the weight of the lamp is so adjusted that it will not tip over.

The Pittsburgh Lamp, Brass & Glass Company are unlike other firms in that they manufacture both the brass and the glass for their fixtures, of which they are now one of the biggest and most exclusive manufacturers in America, having three factories in the Pittsburgh district. The trade mark of the company, "Pilabrasco," which is a combination of the first letters of the company's name, has proven a great success in advertising their products. In addition,



Fig. 2—Reading lamp or for general room

the salesmen of the company recently formed what is known as the Pilabrasco Club, which is already well known from coast to coast.

Refillable Fuses

The A. F. Daum Company have always been prominent in the development of refillable fuses for electric light and power circuits and the illustrations herewith represent their latest type, which for simplicity and rapidity in replacing the fuses surpass anything yet placed on the market. The earlier type of the Daum refillable fuse had the brass cap



Fig. 1—Latest type refillable fuse

threaded over the hard rubber casing. This was objectionable to some extent and a more recent type has been developed where the brass cap is held in position by being threaded to a screw hook which in turn is held in place by setting into two holes bored in the rubber cylinder. The compact appearance of the fuse is shown in Fig. 2.

This company is now developing a fuse in which the wire will be kept under tension so that warping will be pre-



Fig. 2—Fuse assembled

vented. The ordinary fuse wire as it becomes heated by excess current increases in length, thus removing all strain. As a result the fuse wire does not part until the temperature becomes so high that the wire is red or even white hot. Under a slight strain, however, sufficient to prevent the wire from warping, the break occurs before the temperature has been raised sufficiently to even redden the wire. It is with

these facts in mind that the A. F. Daum Company are now developing their latest fuse.

Insulator Supports

The accompanying illustrations represent different types of universal insulator supports manufactured by the Steel City Electric Company. These are specially designed malleable iron clamps for securing insulators to open steel frame work for wiring mills, foundries, factories, shops, bridges, piers, elevated railways, subways, train sheds and similar

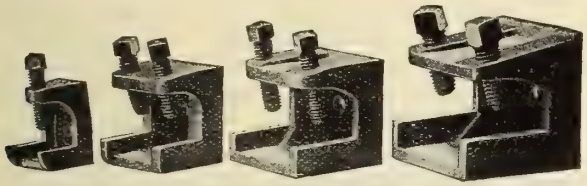


Fig. 1

structures. They are easily attached and by their use electric wiring for lights, motors, generators, cranes, etc., can be installed with a considerable saving of labor and material. Fig. 1 represents a number of different sizes of these insulator supports and Fig. 2 shows the same supports with insulators attached. If necessary two insulators can be

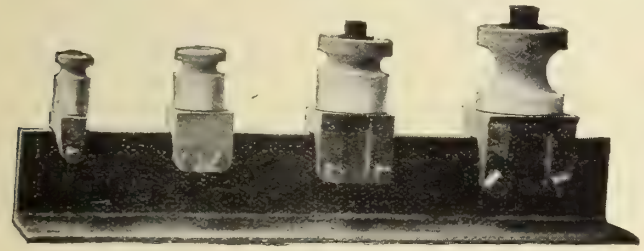


Fig. 2

fastened to each support to carry two circuits or for supporting heavy cables.

In addition to insulator supports the Steel City Electric Company manufacture fixture stems and beam straps; bushings and locknuts, conduit benders; floor outlets; outlet boxes, etc.

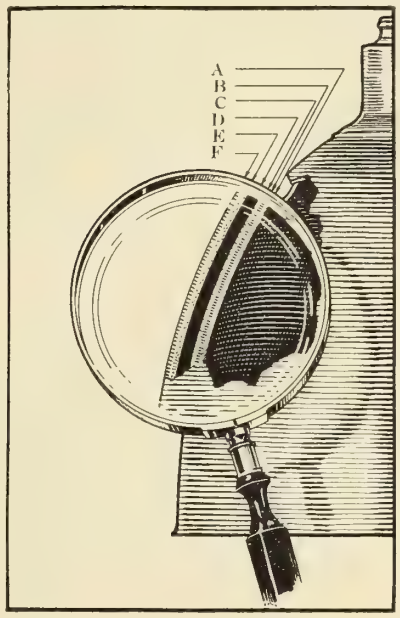
Electrical Exhibitions

Two electrical exhibitions are being held in Montreal and Toronto respectively. The dates of the Montreal exhibition are November 1st to 8th, and Toronto November 10th to 15th. The Montreal exhibit is being shown in the Arena, St. Catherine Street West, and the Toronto one in the Arena, Mutual Street, both buildings being well suited for the purpose. The object of the exhibitions is to demonstrate to the public the uses and developments of electricity in its various modern applications. The use of electricity in the home, the factory, on the farm and in medicine and surgery will be demonstrated in both exhibitions, and there will be numerous scientific and interesting special features. An idea will also be given of the general use of electricity, as for example, by showing an electrical home with occupants, an electrical farm and an electrical hospital equipment.

"Cleanezy" Finish

The "cleanezy" aluminum finish reflector illustrated in the accompanying reproductions is a special recent development for industrial lighting by the Holophane Company, Limited. Reflectors of the ordinary aluminum finish show a marked depreciation in efficiency after a short service as a result all dirt particles, which it is almost impossible to remove, becoming lodged in the pores of the coating. In the "cleanezy" finish the transparent coating "A" (see Figure) forms a smooth protective surface which does not collect dirt readily and is easily cleaned either with soap and water or with diluted ammonia.

As shown by the magnifying glass in the illustration the various coatings are as follows—coat (E) a high temperature non-absorbent coating, first applied by an experienced hand and baked; coat (C) a high temperature white reflecting base is next applied and baked; then in succession coat (F),



a smooth green exterior finish; coat (B) a high efficiency reflecting coat of matte aluminum and coat (A) a transparent, washable, protective coating are applied. Each coat is baked separately as it is applied. There are thus five thicknesses of protective coating at the point where, in ordinary reflectors, rust is most likely to form. In the figure, (D) indicates the special open-hearth steel shell.

Stuart-Howland Company

Thirty-five members of the Stuart-Howland Company's eastern sales force were given a dinner by the company at the City Club, Boston, on Friday evening, September 26th. The toastmaster was Mr. Geo. H. Wahn, sales manager, and addresses were delivered by the president, Mr. Stuart, the secretary, Mr. McDonald, and by many of the salesmen, the keynote of which was general efficiency and "team work." The addresses were interspersed by the singing of college songs, etc., by all present and everything went to show strong loyalty to the company and a particularly good and friendly feeling in its sales force. The Stuart-Howland Company are one of the largest and most progressive electrical jobbing houses and their rapidly increasing business forced them recently to move to larger and more commodious quarters at 131-141 Federal Street.

The Ottawa Municipal Electric Commission have awarded the contract to Canadian Allis-Chalmers, Limited, of Toronto, for supplying 95 "Whiteway" iron posts. The new posts will be 13 feet high, with five 100 watt tungsten lamps in frosted globes, or of exactly the same design as those now in use. The new posts are for the extension of the "Whiteway" system on Sussex and Albert streets and Laurier and Gladstone avenues. About two blocks on each of these thoroughfares will be supplied with the new lighting. The posts will be erected every 75 feet on both sides of the streets.

Montreal Electrical Society

The members of the Montreal Electrical Society opened their winter season by a reunion on Monday, October 6th, at the Edinburgh Cafe, which has been secured for the entire winter, the meetings being held on the first and third Mondays of each month. Mr. Nicholson, the president, reviewed the history of the society and outlined the programme of the coming session. In addition to the list of papers given in our last issue, the following have been arranged for: November 3, Mr. L. R. McDonald, of X-Rays, Limited, "X Rays"; December 1, Mr. W. J. Camp, assistant manager C. P. R. telegraph department, "Telegraph Talk"; January 5, Mr. C. A. Ablett, general manager, Siemens Company of Canada, Limited, "Rolling Mill Equipment"; February 16, Professor Grey, McGill University; March 2, Mr. C. A. Howe, "Recent Advances in Illumination." Mr. W. C. Lancaster, electrical engineer for the C. N. R. tunnel, has also promised a paper; Mr. Coombes, of the Babcock and Wilcox Company, will speak on "Boilers," and Mr. F. C. Burnett, of the Canadian Cement Company, on "Industrial Applications."

Imperial Soldering Paste

The Canada Metal Company, Limited, of Toronto, are putting on the market a line known as the Imperial Soldering Paste which will appeal to all electricians. Before offering this paste for sale the company sent free samples to many of the largest users in the Dominion and reports following a number of trials have been highly satisfactory. It is claimed that this soldering paste is up to the usual high standard of goods manufactured by this company.

Trade Publications

Trolley Guards—A descriptive card issued by the Ohio Brass Company, describing their National railroad trolley guard and explaining its advantages.

Travelling Blocks.—A pamphlet issued by the Herbert Morris Crane & Hoist Company, descriptive of the Morris travelling chain blocks with worm gear.

Electrical Specialties—Bulletin No. 5, issued by the Tregoning Electric Manufacturing Company, of Cleveland, Ohio, describing attachment plugs, rosettes, and receptacles.

Sewing Machine Motors.—Bulletin No. A 4102, issued by the Small Motor Department of the Canadian General Electric Company, describing sewing machine motors for family size machines.

Knife Switches—Bulletin No. 19, issued by the Frank Adams Electric Company, St. Louis, describes various types of knife switches, fuse blocks, fuse terminals, etc., manufactured by this company.

Motors—Bulletin Nos. 101 and 102, issued by the Electric Manufacturing Company, St. Louis, describing with illustrations the advantages, construction and uses of this company's single phase and polyphase motors.

Hubbell Devices—Bulletins have just been distributed by the R. E. T. Pringle Company which describe a number of recent Hubbell productions. These include motor attachment plugs—all composition; ceiling pull switch rosettes; multi-pole attachment plug with two outlets and Edison lamp base; and Hubbell attachments for pull sockets.

Aluminium Bus-bars—Bulletin No. 33, issued by the British Aluminium Company, Limited, from their Canadian office. The bulletin deals with the erection and jointing of aluminium bus-bars and connections and is well illustrated.

Separators—Section A, on live steam separators issued by the Harrison Safety Boiler Works for whom the Canadian Allis-Chalmers, Limited, are Canadian agents. Sections B. C. D. and E. describe other types of separators manufactured by the same company.

Small Motors—Bulletin issued by the Canadian General Electric Company, describing their drawn steel type of fractional horse power motors, with applications. The applications outlined in the little booklet include sewing machines, buffing and grinding outfits, portable drills, washing machines, hat cleaners, small house pumps, etc., etc. For this work motors ranging in size from 1/50 to ¾ of a horsepower are necessary.

New Companies

The Titan Electric Supply Company has been registered.

Lafreniere & Bissonnette, electricians, have been registered.

The Murphy Electric Company, Limited, has been incorporated with head office Victoria, B.C.

The Ogden Electric Manufacturing Company, Limited, has been incorporated with head office Toronto.

The Canadian Krantz Electrical Manufacturing Company, Limited, has been incorporated with head office in Toronto.

The Hamilton By-product Coke Ovens Company, Limited, has been incorporated and will establish a plant in Hamilton for the manufacture of coke and the utilization of the by-products. The plant will be electrically equipped.

The Upper St. Lawrence Power Company, Limited, has been incorporated under a Dominion charter, at a capital of $3,000,000, with head offices in Toronto. The operations of the company may be carried on in the Dominion of Canada or elsewhere. The law firm of Blake, Lash, Anglin and Cassels, of Toronto, are solicitors for the new company.

New Books

Overhead electric power transmission, principles and calculations—by Alfred Still, M. I. E. E., etc., associate professor of electrical engineering, Perdue University. McGraw-Hill Book Company, Inc., 239 West 39th Street, New York, publishers. Price $3.00 net. The subject of overhead transmission is treated mainly from the point of view of the engineer whose duty it is to make the necessary calculations and draw up the specifications. Nevertheless the book deals also with the fundamental principles and scientific laws which determine the correct designs of overhead electric transmission lines and will be found to meet the needs of the practical engineer. It has been the aim of the author to give the reason of things—to explain the derivation of practical methods and formulae—in the simplest possible terms; consequently higher mathematics has been avoided but vector diagrams and trigonometrical formulae have been freely used in the solution of the problems. The book should, therefore, be useful not only to the practical designer of transmission lines but also to engineering students who are specializing along the lines of power generation and transmission.

Transformer Practice—by William T. Taylor, M. I. E. E., etc. McGraw-Hill Book Company, Inc., Publishers. Price $2.50 net. The author deals with manufacturing, assembling, connection, operation and testing of transformers in this second edition of a work which was originally published in 1908. The work is particularly intended for those who are operating or constructing plants or transformers and is written with a view to assisting engineers out of certain operating difficulties which can be readily solved by some temporary arrangement of apparatus in hand such as using certain changes of phases. The book is full of useful hints for the operating and constructing engineer.

Current News and Notes

Brandon, Man.

The construction of a $100,000 telephone exchange which was to have been carried out by the Manitoba Government has been postponed until next year.

Calgary, Alta.

The city council have closed a five year's agreement, with the Calgary Power Company, to purchase 5,000 h.p. per year at $26.00 per h.p. year.

Charlottetown, P. E. I.

The Charlottetown electric light plant has been purchased by the Maritime Trust Co. This is the same company which recently acquired the Yarmouth Street Railway Company's system.

Cookshire, Que.

The Westbury Electric Light & Power Company, H. A. Worby, manager, have just completed two large cement ice breakers and a large forebay with wall rising about 12 ft. above the medium water mark and having a total height of forebay wall of 30 ft.

Donnaconna, Que.

The Donnaconna Paper Company of Donnaconna, Que., have ordered electric motors ranging from 150 h.p. downwards and aggregating 1,330 h.p., from the Canadian General Electric Company.

Dundas, Ont.

The Dundas Hydro-electric Commission have contracted to erect 30 ornamental standards in West Hamilton.

Edmonton, Alta.

It is understood that the price of the street railway fare will be increased to 5 cents straight, with the exception of workman's tickets which will be accepted between 6 and 8 in the morning and 5 and 7 in the evening. School-children's tickets will continue to be sold in books of 50 for $1.25.

Elora, Ont.

A by-law will be submitted on November 3rd to authorize the expenditure of $10,000 on a distribution system. A line will be run out from Guelph sub-station.

Estevan, Sask.

The by-law submitted on September 23 authorizing the expenditure of $46,000 on an electric lighting and power system carried.

Fergus, Ont.

A by-law will be submitted on November 3rd to authorize the expenditure of $16,000 on a distribution system. A line will be run out from the Guelph sub-station.

Gravenhurst, Ont.

The Gull Lake Lumber Company has been incorporated with head office at the town of Gravenhurst. Among the objects of the company are included the generation and distribution of electrical power and the transmission and operation of tramways necessary for the company's business.

Iroquois Falls, Ont.

The Abitibi Pulp and Paper Company have placed with the Canadian General Electric Company an order for electric motors ranging from 400 h.p. downwards and aggregating 2,165 h.p., for their new mills at Iroquois Falls, Ont.

Kelowna, B.C.

The Forestry Department report that the telephone line from Kelowna to the summit of Little White Mountain has been completed. This line puts the forestry department in touch with the best lookout point in the Okanagan district. From the top of the Little White Mountain a splendid view can be obtained of the Okanagan and Kootenay Valleys. The line is 30 miles long. It is composed partly of the Okanagan Telephone Company's line, partly of the South Kelowna Land Company's private line and partly of a trail line built by the department through virgin spruce forest.

Kingston, Ont.

The Corporation of Kingston, Ont., have decided to construct a system of underground conduits upon four of the principal streets, leading from the water front to the up-town district, thus abolishing the unsightly poles. The light, power and telephone wires will be laid in the ducts, which will be of the square bore type. The system of conduits has been designed by the Ontario Hydro-electric Commission, and the work will be carried out under the supervision of the Civic Utilities Committee. A feature will be the large number of small service manholes, thus doing away with the length of service connections into the buildings. It is intended later to instal a system of standard lighting in connection with the conduits. The contract has been awarded to Dietrich, Limited, of Montreal.

Lacombe, Alta.

The municipality of the town of Lacombe will install a twenty-five light series arc system with six series, six ampere, tungstens. The requirements will include panel and instruments, lamps and regulators.

Langham, Sask.

The new electric light plant was placed in commission on September 15th.

London, Ont.

A new 10,000 line switchboard was recently placed in commission in London, Ont., by the Bell Telephone Company. The switchboard is located in an addition recently built to the company's original exchange.

Montreal, Que.

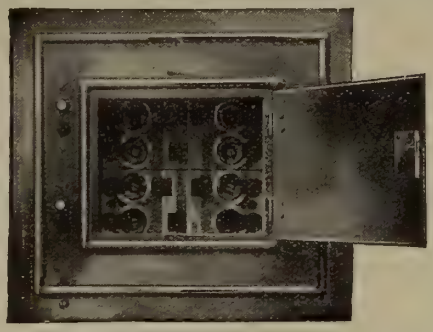
The Canadian Crocker Wheeler Company announce the removal of their Montreal office to the new McGill Building, Suite 607.

The British American Electric Company has been dissolved.

The city council has granted the request of the Montreal & Southern Counties Railway Company for certain extensions to their car lines.

A public offering of $4,500,000 Bell Telephone bonds, on a 5.15 per cent. basis, was over-subscribed on the day of issue. This will enable the company to go ahead with some extensions which were held up, pending fresh capital.

The following contracts have recently been awarded to Dietrich, Limited, Montreal,—the electrical installation of two large round-houses for the Grand Trunk Pacific at Parent and Fitzpatrick, P.Q.; power and lighting equipment of the Guarantee Building, Montreal; electrical equipment of the new Canadian Fairbanks Morse building, Montreal; electrical conduits for the northern extension of Windsor Station, C. P. R., Montreal; underground conduits and illumination by cluster lights of the Champ de Mars, Montreal; a similar contract at St. Johns, P.Q.; the illumination of the new race-course at Dorval, P.Q.; laying and supply of conduits, Kings-



A Radical Departure and Much Needed Improvement

COLUMBIA Push Button Switch Cabinets

Save Cost of Switch Box and Plates.

Push Button instead of knife switches eliminates all danger of accidental contact with live parts, besides assuring longer service, as it is well known that push button switches far outlast knife switches. These new cabinets are much superior to the regular panels and cabinets, they occupy less space and are lower in price. Lock type switches may be substituted for use in public halls, etc. Note the prices. Cabinets only.

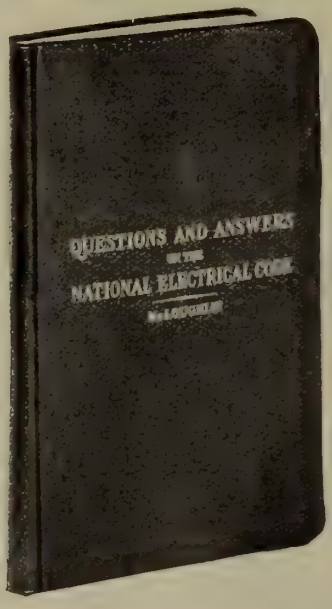
		Prices			
Cat. No.	Circuits	List	Cat. No.	Circuits	List
511	2	$3.50	515	10	$5.50
512	4	4.00	516	12	6.00
513	6	4.50	517	14	6.50
514	8	5.00	518	16	7.00

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It tells at once the answer to the questions on code requirements.
Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.
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Yager's Soldering Fluxes

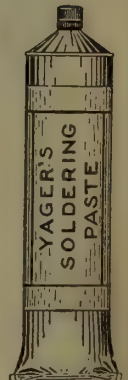
4 Forms—1 Result—The Perfect Joint

Efficiency is the word. Let us co-operate with you to increase the efficiency of your service. Use Yager's Fluxes in any of the four convenient forms — Salts—Stick—Paste — Fluid, to produce joints which will not fail you at the critical moment. No acid in any of them. They make the perfect electrical joint.

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ALEX. R. BENSON COMPANY

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Use the Railway's Trolley Poles



as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

ERECO Combination Railway Lighting Pole Fixtures

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

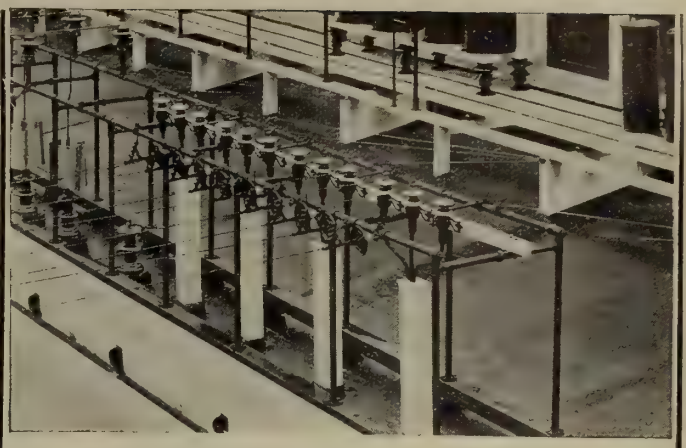
The progressive railway management will gladly co-operate with you with this object in view.

Design No. 10127.

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Designers **Manufacturers**

Canadian Representatives:
Dawson & Co., Limited, Montreal, Winnipeg
N. Y. Office, 30 Church St., Hudson Terminal Bldg.



An Interesting Installation of D. O. A. and D. S. Terminals

The above illustration shows how "Standard" D. O. A. Terminals are used to effect a convenient and economical entrance of aerial lines through the roof of a power house.

Single Conductor 15,000-volt terminals are shown with stubs of lead-covered cable attached.

The illustration below shows termination of these stubs within the station by means of Inverted Type D. S. Terminals.

For further information about "Standard" Terminals and other cable accessories write our nearest office.

Standard Underground Cable Co., of Canada, Limited
Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of electric wires and cables of all kinds, all sizes, for all services, also cable accessories.





Holiday Trade Will Be Just What You Make It

¶ Remember that. And you can build your plans upon no more certain line than Portables. They are at once beautiful and practical, and their appeal is to every class.

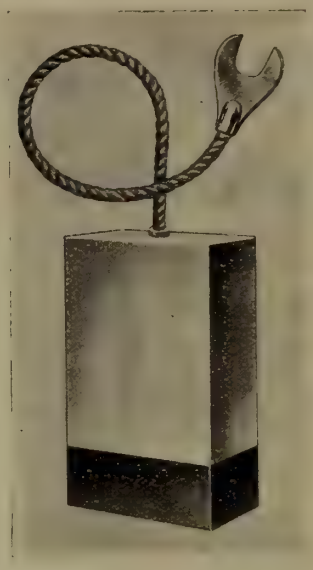
¶ In sales-getting popularity, Pilabrasgo Portables unquestionably stand first. This season's additions to the line show a most remarkable degree of originality, beauty and variety. Every number is potent with sales energy and profit possibilities. You ought to see photos of the line—and soon. A line will bring our man.

THE PITTSBURGH LAMP, BRASS & GLASS CO.
OF CANADA, LIMITED

119 Wortley Rd.
London, Ontario

PILABRASCO

R. E. DAVIS
Representative



Becker Dynamo and Motor Brushes

Becker brushes are famous for their fine texture, perfect lubrication and freedom of grit or materials liable to damage the commutation.

Becker brushes are long lived and are made in every size and shape.

Get our catalogue containing prices.

Send us your inquiries for any style of Gauze—Carbon or Magneto Brushes

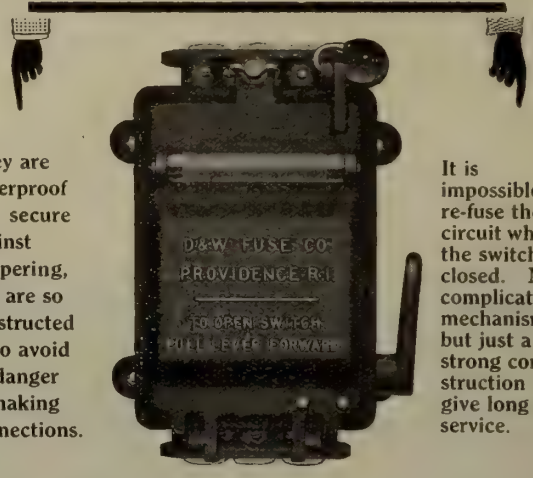
Becker Brothers

561 W. Washington St., Chicago, Illinois

"D & W" Fused Switch Boxes

250 Volts

NOTE THESE POINTS



They are waterproof and secure against tampering, and are so constructed as to avoid all danger in making connections.

It is impossible to re-fuse the circuit when the switch is closed. No complicated mechanism, but just a strong construction to give long service.

D. & W. FUSE CO., Providence, R.I.

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Long Lengths 7 ft. Thick Walls 3/8 inch. Long Joints 5/8 inch,

We will absolutely guarantee a puncture strength of 50,000 volts and an absorption of moisture for 100 hours of less than ¾ of 1%.

Comparison of above figures with other types of Fiber Conduit will show the superiority of our product.

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We Have a Bell For Every Purpose

There can be only **one best** and that is the **Schwarze.** **No. 12 Common Magneto Extension** for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire **is all active.** Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and **very much louder,** and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof. Write for catalogue. **All resistances.**

Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents

White's Improved Porcelain Strain Insulator



Try this New and Better

STRAIN INSULATOR

Made in Four Sizes. Write for Illustrated Bulletin.

Will furnish Sample if desired.

T. C. WHITE COMPANY

1124 Pine St., ST. LOUIS, MO.

Special Notice

The name of the

Central Electric & School Supply Co., Limited

has been changed to the

Central Electric Supply Co., Limited

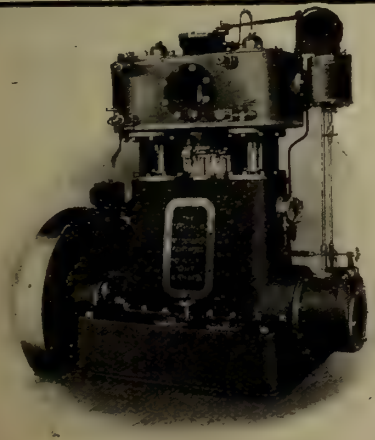
We have disposed of our stock of School Supplies and are going to use our entire building for electrical supplies and apparatus in order that we may carry a larger and more complete stock and give our customers better service.

Write for catalogue No. 3

Central Electric Supply Co., Limited

36 Adelaide St. West, Toronto

Ontario, Canada



Vertical, Forced Lubrication

Quick Revolution Engines

With Combined Throttle and Expansion Governor

These engines are giving excellent service wherever installed. They are built for service and are economical in consumption of steam and require little or no attention while running. The materials used are in accordance with British Admiralty Specifications. Ask for detailed information.

All Engines are Tested under Steam before leaving our works

THE GOLDIE & McCULLOCH COMPANY, LIMITED

Head Office and Works: Galt, Ontario, Canada

Branches:—Toronto Montreal Winnipeg Vancouver and St. John, N. B.

ton, Ont.; and the installation of the electrical fixtures of the Read Building, Montreal.

The Montreal Electrical Service Commission expect to have the wires placed in the underground conduits on St. Catherine Street by May 1st next. The commissioners have therefore suggested that the city council should pass a by-law requiring that all buildings erected, and to be erected, on this and other streets should be wired to suit the underground distribution. All customers for electric light or power must change their interior wirings to the satisfaction of the Canadian Fire Underwriters' Association.

The Canadian Fire Underwriters' Association, Montreal, have opened an office in the Hochelaga Bank Building, Three Rivers, P.Q., with Mr. A. Pruneau in charge. This branch office will deal with the inspection of electrical work in the district.

The construction of lines on new routes and the improvement of the permanent way have resulted in the acceleration of the service of the Montreal Tramways Company. This mainly relates to the central district, and the City Council are desirous that the company shall give better accommodation in the outer wards. At an informal conference between the Council and the Controllers, the latter were asked to prepare a report on the extension of the street car service, and on the opening of new car routes to meet the demands of the outside wards.

In connection with the underground conduits nearing completion on St. Catherine Street, Montreal, Mr. A. Parent, superintendent of the civic lighting department, has prepared a report for the controllers recommending a new lighting scheme. The removal of the poles makes this imperative. Mr. Parent favors the single light standards in preference to five cluster lights, the tests made leading to the conclusion that one powerful light on a suitable standard gives a more effective distribution than the cluster system. Mr. Parent proposes to increase the present number of 57 arc lights, 350 feet apart, and suspended on wooden poles to 142 and to place them alternately on either side of the street, reducing the space to 150 feet between each lamp. The standards will be of iron, about 14 feet high, and the arc lamp on the top will be without a reflector, throwing the light higher up than at present. It is suggested by Mr. Parent that the single light standards should be installed in the down-town streets as soon as the conduits are constructed, but that in residential streets clusters might be used.

Summing up, Mr. Parent recommends the inverted magnetite arc lamp for the following reasons: as being cheaper in capital and operating costs; as being superior from a commercial and artistic standpoint; as being more suited to the crowded conditions of the principal business streets; and as being suited to the present equipment of the Montreal Light, Heat and Power Company and the city's contract with that company.

The Canadian British Insulated Company, Limited, Montreal, have just done a smart piece of work in cable laying for the Shawinigan Water and Power Company. The cable is No. 2 B and S three conductor paper insulated lead covered and armoured for submarine purposes, 4,300 feet in length, and 12,000 volt working pressure, tested after being installed at 25,000 volts. It is being used as a transmission line from the north to the south shore of the St. Lawrence, and was laid across the river from Lanoraie, P.Q., to the Sorel Electric Company. The cable was placed on a scow, and laid from one end to the other in exactly 20 minutes.

Mr. A. E. Grant, in addition to being appointed managing director of the Canadian British Insulated Company, Limited, Montreal, has later been elected president, in succession to Mr. Lawford Grant, who has now entirely severed his connection with the company.

Moose Jaw, Sask.

The new 1,500 kw. generator being supplied by Messrs. Willans & Robinson and which was expected to be in operation by October 15th has been delayed and will probably not be operating much before the new year.

Neepawa, Man.

The by-law recently submitted asking authority to expend $18,000 on extensions to the municipal electric light system was rejected by a considerable majority.

Niagara Falls, Ont.

The Electrical Development Company, who have now practically completed the installation of all the units for which the power house is designed, have closed a contract with a United States company and will export another 46,000 h.p.

North Sydney, N.S.

A contract has been awarded by the Western Union Telephone and Telegraph Company for laying five miles of underground cable with a manhole every 1,000 yards.

Ottawa, Ont.

The Ontario Hydro-electric Power Commission have submitted their plans to the Dominion Government for a high tension transmission line across the St. Lawrence River. This line will carry power to be purchased from the New York and Ontario Power Company who have a plant at Waddington, N.Y.

Pitt Meadows, B.C.

Electric power will soon be supplied to this section by the Western Canada Power Company who are running a line through this section in order to reach certain properties further north.

Portage la Prairie, Man.

Negotiations are still proceeding regarding the supply of power at this point. The city of Winnipeg offer power at $20 per h.p. year but Portage la Prairie would be required to build their own transmission line and distributing system.

Prince Albert, Sask.

Contracts have been let to Messrs. Kilmer, Pullen & Burnham for the supply of generators for La Colle Falls water power development.

Regina, Sask.

The operating returns of the street railway system of Regina for the week ending September 20th showed a revenue of $3,437 and the number of passengers carried 83,674. For week ending September 27th corresponding figures were $3,590 and 88,581.

Sidney, B.C.

A contract has been drawn between the Sidney board of trade and the B. C. E. R. Company regarding the installation of a street lighting system in Sidney.

St. Thomas, Ont.

An agreement has been signed between the Michigan Central Railway Company and the city of St. Thomas, whereby the latter supply the company with electric power up to 1,200 h.p. for their shops in St. Thomas. It is understood that the city is also negotiating with the Pere Marquette Railway Company for a similar contract.

St. Catharines, Ont.

Work is progressing favorably on the electric railway line of the Niagara, St. Catharines and Toronto Railway Company, which will connect St. Catharines with Niagara-on-the-Lake. This is an eleven mile extension which it is expected will be in operation before the winter sets in.

St. Marys, Ont.

The light and power commission at a recent meeting decided to replace the present street lighting system with orna-



The WESTON SYNCHROSCOPE

Constitutes a very simple and absolute *perfect solution* of problems involved in coupling alternating-current machines in parallel without danger or sensible disturbance of circuit conditions.

The indications are infallible.

There is only one object to observe

The movement of the pointer is smooth and certain; it inspires confidence.

It indicates exact synchronism within 1 deg. of true phase coincidence over a wide range of frequency and voltage.

Send for catalog giving full *description of this unique instrument* and also our full line of A. C. and D. C. instruments for Switchboard, Portable and Laboratory Work.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York Office and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

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Main Offices and Works
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Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 618 Union Trust Bldg.
Montreal, Winnipeg, Vancouver, Calgary } Northern Electric & Mfg. Co.
Toronto, 76 Bay Street.

London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. George.
Berlin, Genest St. 5, Schoenberg
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TRADE MARK REGISTERED

are drawn from steel and are light in weight, neat in appearance, and their durability cannot be surpassed. They are the ideal conduit fittings for up-to-date work and should be used by all contractors and those desiring their installations to be perfect in all respects. "UNILETS" are mechanically right. Furnished in either Black Enameled or Sherardized finished.

Rectangular Steel Unilets for ½" to 3" conduit inclusive



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Cat. No. 9001



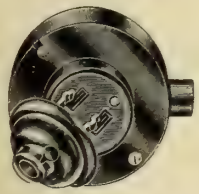
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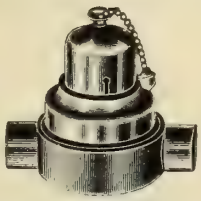


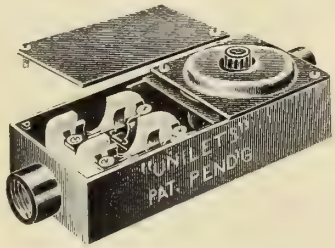
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Cat. No. 7402 Snap Switch Unilet with Hubbell No. 5795 Pull Switch Attached.



Combination Cut-Out and Snap Switch Unilet-Double Pole—250 volt.



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Main Office and Factory **CHICAGO** **212-214 N. Jefferson Street**

For Sale in Canada by

The Mainer Electric Co., Ltd., Winnipeg **Marshall-Wells Co., Ltd., Winnipeg** **Chapman & Walker, Ltd., Toronto**

mental tungsten clusters. In addition, a number of 100 c.p. single units will be installed.

Stayner, Ont.

Hydro-electric power supplied from the Severn River was turned on in Stayner on September 25th.

South Vancouver, B.C.

The South Vancouver muncipal council have unanimously passed the following resolution:—"That in the opinion of this council the establishment of a municipal electric plant is a pressing necessity, and would prove of great advantage to the interests of the municipality.

Toronto, Ont.

The Interprovincial Engineering and Contracting Company has been incorporated with head office at Toronto.

The Ontario Railway and Municipal Board have issued further orders for the Toronto Suburban Railway Company to proceed with their extensions on Pacific Avenue.

The Forest Hill Railway Company are asking the government for permission to proceed with the construction of their line, and it is expected work will commence shortly.

The Municipal Electrical Association expressed approval of the organization of a purchasing and testing department to be controlled by the Hydro-electric Power Commission of Ontario for the purpose of supplying the various municipalities with necessary equipment at very low rates.

The Upper St. Lawrence Power Company, Limited, has been incorporated with head office Toronto.

Transcona, Man.

In connection with the distribution of light and power in Transcona, an order was handed down last week by Judge Robson which calls for the adoption of a principle of joint ownership for pole lines in the town.

The Canadian Crocker-Wheeler Company, of St. Catharines, have been awarded the contract for motors and auxiliary electrical equipment required by the G. T. P. shops situated here.

Vancouver, B.C.

The B. C. E. R. Company have increased their rates in and around Vancouver and Victoria to 5 cents straight with certain limited hour special rates. It is claimed by the company that this has been rendered necessary as a result of the increased cost of operation. At the same time considerable reductions have been made in the lighting rates in a number of Vancouver suburbs, placing the latter in line with the rates charged in Vancouver city.

The Bell Telephone Company have just issued a new directory, which shows 53,000 subscribers. The increased size of this directory has made it necessary to enlarge the pages so that two columns of names are now given on each page, and the thickness of the book has in this way been considerably reduced.

Victoria, B.C.

The Canadian Collieries (Dunsmuir), Limited, have decided to install an extensive electrically driven pumping system. There will be four separate units. Two will be driven by 75 h.p., a.c. motors and a third by a 75 h.p. d.c. motor, each unit being capable of delivering 350 gallons per minute against a head of 370 feet. The fourth unit consisting of two pumps working in series will deliver 350 gallons per minute against a head of 740 feet. The pumps will be built by Canadian Allis-Chalmers and the motors by Canadian General Electric Company.

Welland, Ont.

The Hydro-electric Power Commission of Ontario are commencing construction work on a 46,000 volt transmission line between Niagara Falls and Welland to serve manufacturers in the latter district. The line will be designed for an ultimate capacity of 50,000 horse-power.

Work is reported to be progressing favorably on the extensions to Parkway Heights and along West Main Street of the Niagara, Welland and Lake Erie Railway Company.

The Hydro-electric Power Commission of Ontario have placed an order with the Canadian General Electric Company, for six transformers each 3,500 kw., 46,000/2,300 volts. These are to be used in Welland in connection with the new 46,000 volt line to be constructed from Niagara Falls.

Westmount, P.Q.

The Westmount council have appropriated $25,000 for street lighting for the coming year. The council are carrying out a new scheme of lighting which will soon be in operation.

Woodville, Ont.

The sum of $4,000 will be expended on an electric distributing plant.

Winnipeg, Man.

A contract has been awarded for a quantity of lead covered cable to the Imperial Wire & Cable Company.

A number of carbon flaming arc lamps are at present undergoing a test by the city of Winnipeg with a view to their adoption for street lighting purposes in certain sections of the city. A great performance is claimed for these lamps by the manufacturers and they have the additional advantage of operating on alternating current circuits.

Tenders have been called, by the City of Winnipeg, for the manufacture, delivery, installation and testing at the Grand Trunk Pacific shops at Transcona of transformers and switching apparatus; also for the manufacture and delivery of two 44 kv.a. induction feeder regulators and accessories.

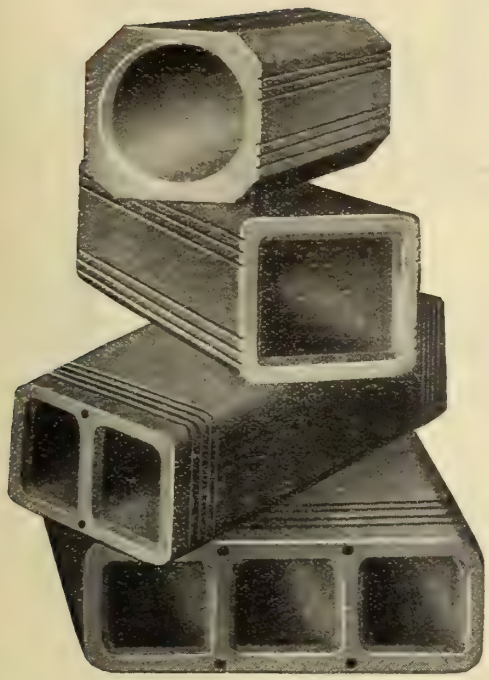
Public Utilities Commissioner Robson is, with the assistance of expert engineering advice, making an investigation of the merits and demerits of the grounded secondary system of distribution and has called upon the officers of the Winnipeg Electric Railway Company and the Light and Power Department of the City of Winnipeg to submit reasons why an order should not be made enforcing the adoption by them of this system. The system of grounding has been ordered and adopted by a number of municipalities and Judge Robson feels that, unless existing conditions in Winnipeg are such as to render the adoption of this extra precautionary measure unnecessary, such an order should be issued. A number of conferences between the two operating companies and Judge Robson have been held, and it is expected that a definite arrangement will be made within a few days.

While passing through the city of Winnipeg recently, Sir William McKenzie was interviewed regarding the rumors in connection with the sale of the street railway system. He admitted that offers for the concern had been received on different occasions, and stated that although it might be sold there was at present no transaction in the air for its sale.

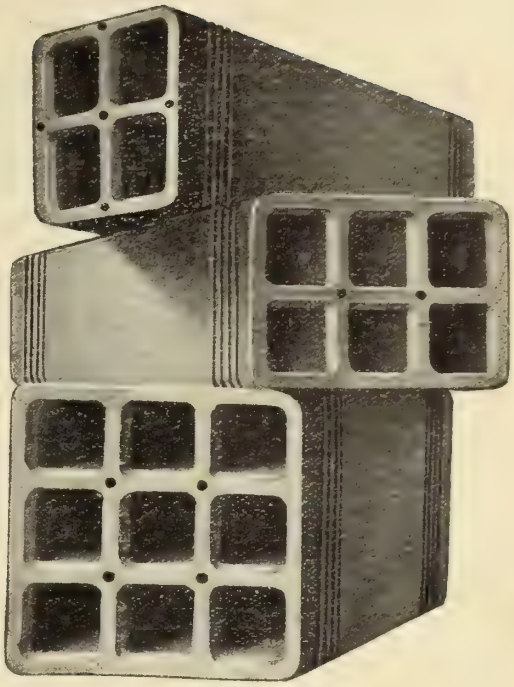
Westboro, Ont.

By a majority of 51 votes the ratepayers of the village of Westboro have decided to award the contract for lighting the streets of the village for the next ten years with 60 100-watt tungsten lamps at $13 per annum per lamp to the Ottawa Electric Company. The total number of votes cast when the by-law was submitted was 72. The poles for the lamps have been in place for some time. The company has commenced to install the lamps.

The Canadian Union Electric Company, Limited, beg to announce that Mr. W. H. Bytham has resigned his position as manager of their Montreal branch to take up a directorship in the firm of The Electrical Repair & Contracting Company, of Montreal. For the time being Mr. Curling is in Montreal, looking after the interests of the company but shortly a fully equipped engineer will be appointed to fill Mr. Bytham's place.



CLERMONT



DUCT

VITRIFIED SALT GLAZED UNDERGROUND CONDUIT

Almost exclusively used in all underground construction in the Eastern Provinces of

CANADA

and most highly regarded in the

UNITED STATES

Annual capacity—8,000,000 ft. Nearest plant to Canada

Independent—Progressive—Competitive

Clermont Sewer Pipe Company

50 Church St., NEW YORK

B. S. BARNARD, Vice-President—Manager of Sales

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

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We buy our machines at our own price and can quote prices for export to Canada to interest you.

We have an enormous stock in all lines of

125 v. D. C. generators.
250 v. D. C. generators.
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Single phase 60 cycle motors.
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Three phase 60 cycle motors.
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Send for our "Monthly Bargain Sheet" showing complete list of machines on hand with net prices. Every machine sold is completely overhauled and fully tested at our works before shipment, and is sent out practically "as good as new." t.f.

We Buy, Sell, Rent, Exchange and Repair.

GREGORY ELECTRIC CO.
CHICAGO, ILLINOIS

FOR SALE

A Special Bargain

Magneto Switch Board in first class shape, Has an ultimate capacity of 50 lines and 12 cord pairs, night bell and hand generator complete. Address Box 886, Electrical News, Toronto. 20

Positions Wanted

Electrician with 5½ years' experience, familiar with a.c. and d.c. currents, desires position either as Switchboard operator or as manager of small plant. Address Box 891, Electrical News, Toronto. 20

An Engineer (28) A.M.I.Mech.E., A.M.I.E.E., desirous of making a change, is open to receive offers from those requiring a first class man to fill a responsible position. Advertiser at present holds post of Mechanical Engineer and Electrical Superintendent to one of the largest Mining and Industrial concerns in Canada, has seen considerable service abroad and would go anywhere at all. Is tactful and energetic with strong initiative and organizing capacity and has highest credentials. Salary according to locality. Apply Box No. 896, Electrical News, Toronto. 20-22

Positions Vacant

WANTED—Resident agents and salesmen in cities and territory on commission basis wanted by manufacturer of the largest line of Automatic Electric Beer Pumps, Air and Garage Pumps. Responsible, experienced dealers preferred. Address Varwig Mfg. Co., Cincinnati, O. 19-20

WANTED

For Eastern Canada a first class meter man who can handle installation and testing of integrating graphic demand meters in a large company. None but men with experience and executive ability need apply. State age, experience and minimum salary expected. A good opening for an energetic and ambitious man. Apply to P. O. Box 170, Montreal, Que. 20

Electrical Engineer

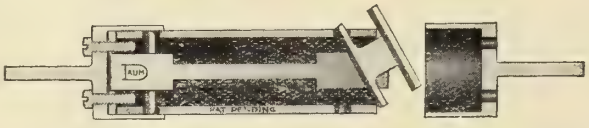
The City of Prince Albert, Saskatchewan, requires an experienced Electrical Engineer as General Manager. Thorough experience in business organization and management and in the designing of steam stations is essential. Give full particulars and state salary required.

Applications must be received by October 31st.

C. O. DAVIDSON, City Clerk.
Prince Albert, Oct. 1, 1913. 20

FOR SALE

Canadian Rights for an Electric Device which has been an immense success in the United States. Address Box 887, Electrical News, Toronto. 20tf.





DAUM

Made first successful fuse with threads on fibre tube, but found in practice that threads stripped, through the shrinking or burning of fibre. We have overcome all of these objections in our Latest Types by having a Wire Cotter with two prongs inserted in openings in tube. The fuse element is held between the bar and cap—threaded on wire cotter, and no matter how fibre expands or contracts you have a perfect electrical contact. The Wire Cotter when once inserted remains permanent. All that is necessary is to remove cap to replace the fuse-element.

In our blade contact, you have the fuse strip with the capacity stamped thereon and guaranteed to meet requirements of electrical devices of these types.

Catalogue and samples for the asking, up to 100 amperes

Sole Manufacturers

A. F. DAUM CO. **PITTSBURGH, PA.**

"BANNER" Lighting Fixtures

BANNER TRADE MARK

The designs are original, practical and extremely artistic. "Banner" Electric Fixtures combine high-grade quality of material with superior workmanship.

Our specialty is making fixtures from original drawings and creating designs according to suggestions outlined by our customers.

Submit your next lighting job to us and let us estimate on it.



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Ontario Lantern & Lamp Co., Limited,

HAMILTON, CANADA.

Efficiency Methods Pay Dividends

because under them costs are figured in **cost-for-service** terms and not on the unit-cost basis. Figured this way

"Le Carbone" Brushes

Made in France

are the Cheapest on the Market



They Bring Down the Yearly Brush Cost.

They Eliminate Commutator Wear.

They Increase Car Mileage.

They Reduce Armature Room Expense.

A TYPE of Le Carbone Brush once installed to meet your conditions will always meet them on subsequent shipments.

The quality of Carbone Brushes never varies.

Their efficiency is uniform. Have you a copy of the Le Carbone Brush Book?

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Dietrich LIMITED

Underground Conduit Systems

We are specialists in this class of work and are fully equipped for carrying any installation to completion no matter what natural difficulties may present themselves.

And, our experience covers Canada from Coast to Coast.

Consult

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300 Read Bldg.
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Goods manufactured by

The Canada Metal Co., Limited

Have a Reputation for Quality

IMPERIAL SOLDERING PASTE

Absolutely the finest soldering paste on the market.

IN TINS
2 oz.
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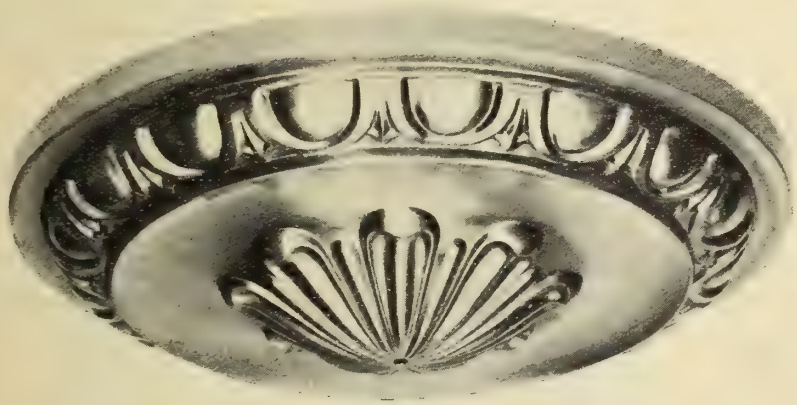
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The CANADA METAL CO., LIMITED
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Branch Factories: MONTREAL and WINNIPEG

Write Us To-day



For your requirements in

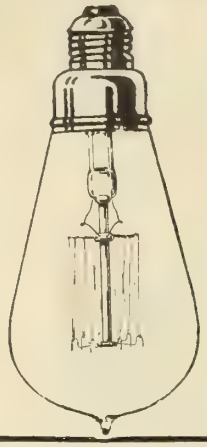
Electric Fixture Parts and Fittings Brass and Steel Chain

We know that we can save you money in our lines and every business man's policy is to buy right, (so here's the place.) Largest stock in Canada, prompt shipments.

New Catalog No. 2 just issued. Get one.

W. H. BANFIELD & SONS

120 Adelaide St. West, Toronto, Can.



DID YOU EVER TRY

Ile-Wire Drawn Tungsten Lamps?

The only lamp giving entire satisfaction and bearing a written guarantee.

Guarantee—"We agree to credit account, replace lamps, or refund amount paid for the lamps including transportation charges if they do not prove satisfactory."

Dealers Write Us for Prices. It Will Pay You.

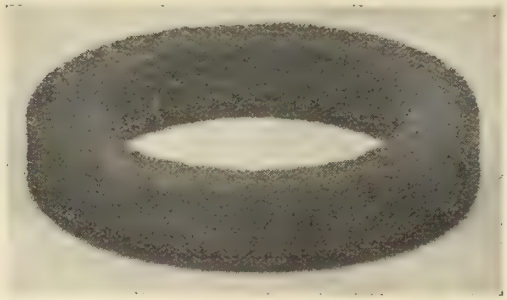
SHUMAN ELECTRIC COMPANY, LIMITED

Distributing Agents for Canada

1010 New Birks Bldg. MONTREAL

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Mechanical Felt Goods



At Gananoque, Ont., we have the dies, the plant, the felt, the men and the experience to turn out mechanical felts that are cheaper and better than can be obtained from any other source.

If it's made of felt, ask Booth

The Booth Felt Co., Limited

GANANOQUE, ONT.

Branch of N. E. BOOTH, Brooklyn, N.Y.

Light Weight Steel Seats

Save the drain on current at "traffic peaks" and power stations.

By a little critical forethought you can save as much as fifteen pounds dead weight per car seat, or some 300 pounds per car. Investigate critically, thoroughly and widely and you will find that

"H. & K. WALKOVER"

CAR SEATS

are the seats that make this economy possible. Their reduction in weight is not obtained at the expense of ruggedness, serviceability, appearance or comfort to passengers.

H. & K. Seats give more room—more comfort—more value than any other seat. Specify them for your new cars.

Hale & Kilburn Co.

New York Philadelphia Chicago

DOSSERT CONNECTORS

are economical and efficient for wiring involved in the reconstruction or extension of existing generating and substations.

Where cables are to be joined or tapped to tubing or solid bus Dossert Connectors are invaluable.

Troubles due to faulty joints are eliminated, while costs are reduced by the facility and simplicity of their installation.

DOSSERT & CO., 242 West 41st St., NEW YORK

IRVING SMITH, Canadian Representative, Unity Bldg., MONTREAL

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A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.



Double-Track Safety and Capacity in Single Track Operation

is assured by means of the

A.P.B. System

A. P. Block System means Absolute indication for opposing movements and Permissive indication for following moments.

It is the one always-safe signal system which provides for maximum single track capacity at minimum cost.

It is the one system that makes variable meeting points absolutely safe and prevents one delayed car from demoralizing the schedules. Now is the time to investigate.

GRS *"Safety First"* GRS

GENERAL RAILWAY SIGNAL COMPANY
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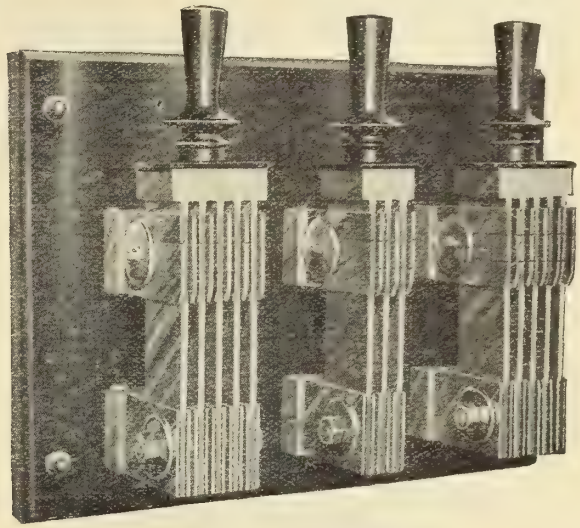
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Lachine, Quebec

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NEW

FA Knife Switch FA

Bulletin No. 19 Listing Knife Switches 30 to 5000 Amperes



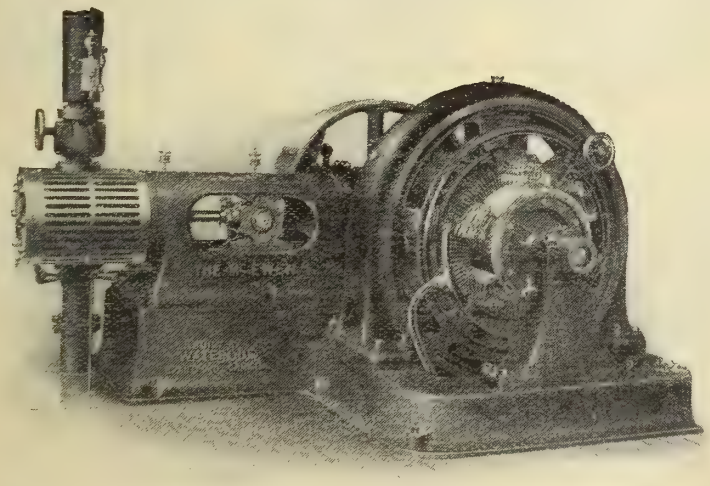
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A McEwen Engine in your Power Plant is your best guarantee against shut-downs and large repair bills. Your plant is not at the mercy of the elements—there are no tie-ups because "something has gone wrong on the transmission line." McEwen Engines are sold on a basis of quality—of economical initial performance—that is maintained year after year.

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Improve with use.

A simple and sturdy design—steam valves that are absolutely tight—a governor that permits of the closest regulation—an oiling system that gives perfect lubrication—These are some of the features that have placed McEwen Engines in hundreds of steam plants in Canada.

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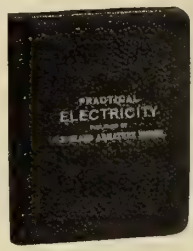
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ELECTRICAL MACHINERY

AND REPAIRS

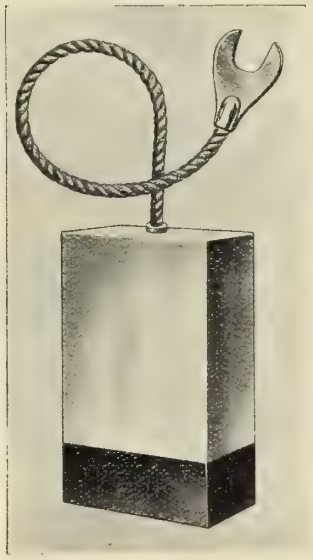
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Representative

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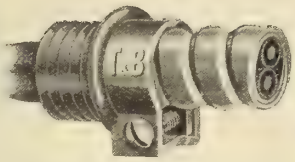
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Pictures of a few fittings you should use



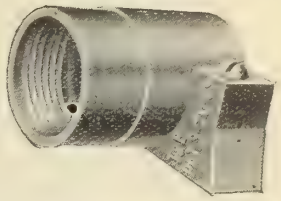
Hood Panel Connector



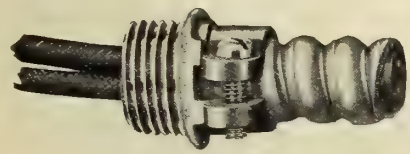
Hood Connector



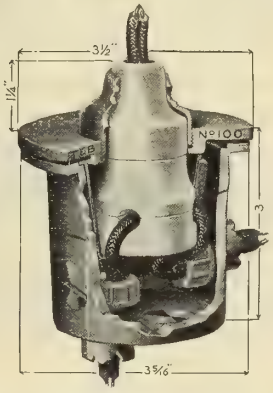
Angle Hood Connector



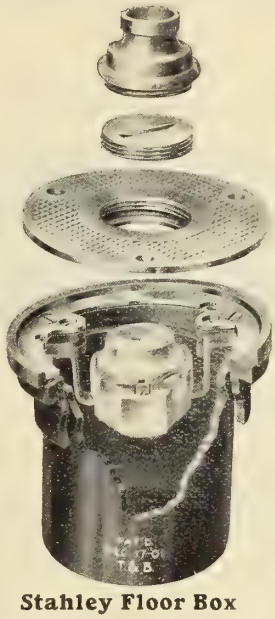
Hood Combination Coupling



Squeeze Connector



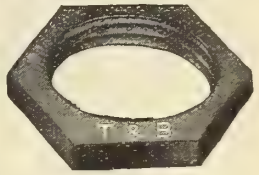
Floor Box No. 100



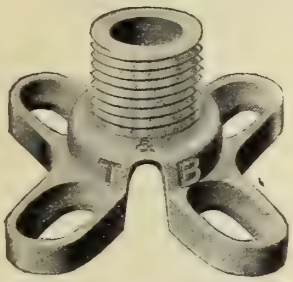
Stahley Floor Box



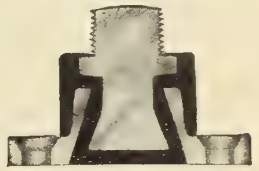
"T & B" Bushing



"T & B" Lock Nut



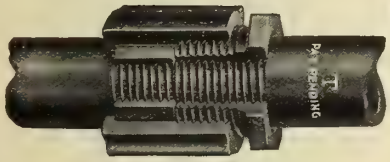
Hickey Fixture Stud



Insulating Stud



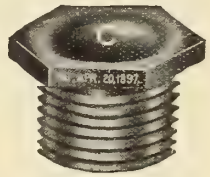
Porcelain Bushing



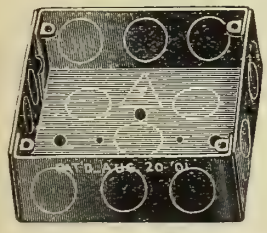
Erickson Coupling



Conduit Hanger



Chase Nipple



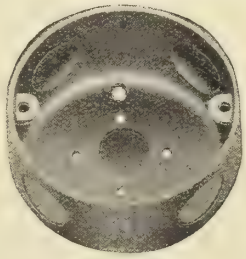
4 in. No. 300 Steel Box



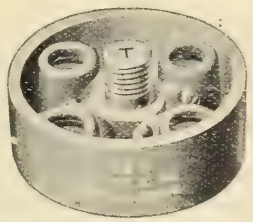
4 in. No. 9 Steel Box



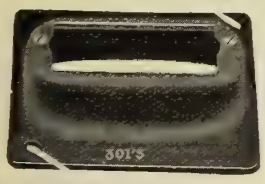
No. 5 Ceiling Box



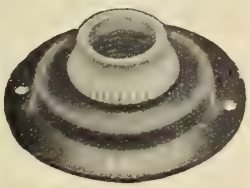
3 in. No. 7 Steel Box



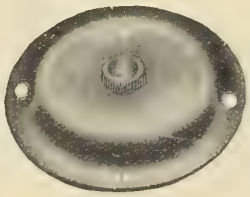
Type A—Cable Box



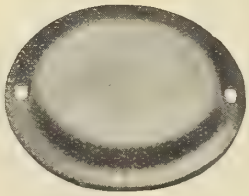
No. 301 Cover



No. 9 F Cover



No. 9 A Cover



No. 9 Cover



Type B—Cable Box

CARRIED IN STOCK BY THE BEST CANADIAN JOBBERS

THOMAS & BETTS COMPANY 299 Broadway NEW YORK CITY



We Have a Bell For Every Purpose

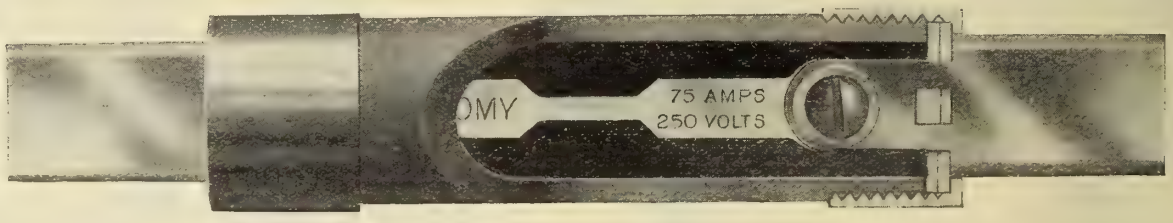
There can be only **one best** and that is the **Schwarze. No. 12 Common Magneto Extension** for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire **is all active.** Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and **very much louder,** and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof. **Write for catalogue.** **All resistances.**

Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
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Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

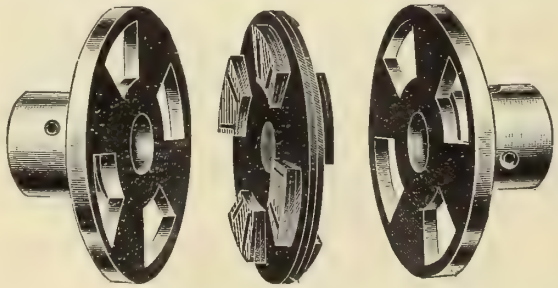
Write for Bulletin, Prices and Discounts

Economy Fuse & Mfg. Co. of Canada, Limited

Herald Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.

THE GRUNDY PATENT FLEXIBLE INSULATED COUPLING



This coupling really insulates and adapts itself to drives in which shafts are not well aligned. It is highly powerful, absolutely positive and silent. Runs either way. Practically indestructible and needs no repairs. Specify the Grundy Flexible Insulated Coupling. Details and prices are ready for you. Write.

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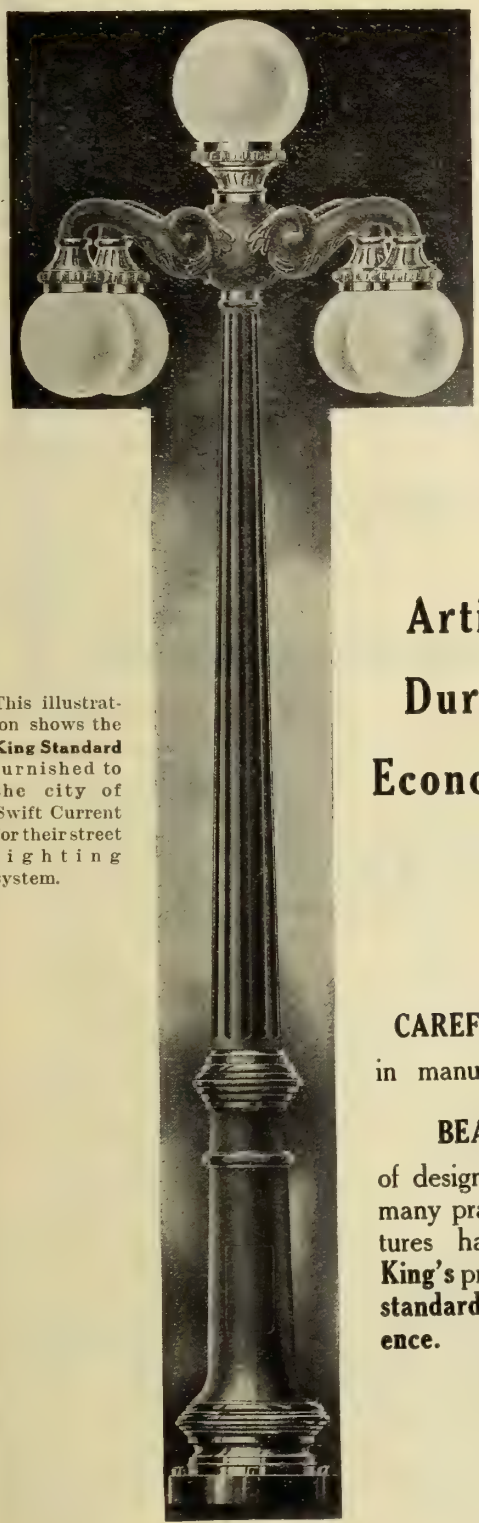
A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

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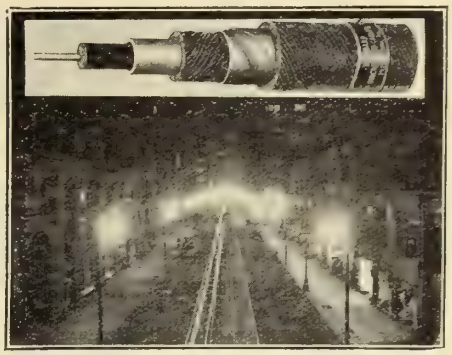
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Illumination of Dearborn Street, Chicago, Ill. "Standard" Steel Tape Armored Cable Installed.

Have You Considered

the advantages of installing "STANDARD" Steel Tape Armored Cable directly in the ground without conduits or manholes? It provides a safe, convenient and economical method of installing an underground transmission system for electric light or power when the more expensive conduit system is not justified by conditions.

"STANDARD" Steel Tape Armored Cable

has been proven best by years of service under severe conditions

This success has been due to the superior quality of "STANDARD" cable, to our long experience in the manufacture and installation of this material, and to the fact that we are able to supply and install *complete* cable systems of this kind.

These are exclusive advantages which we can offer the purchaser of "STANDARD" Steel Tape Armored Cable since we are the only company in this country manufacturing a complete line of joint boxes, junction boxes and terminals which in most cases are essential to the economical installation and operation of such systems.

It will be profitable for you to get further information about "STANDARD" Steel Tape Armored Cable.

Write our nearest office.

Standard Underground Cable Co. of Canada, Limited

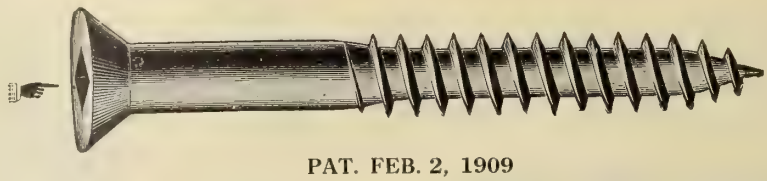
Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
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Manufacturers of electric wires and cables of all kinds, all sizes, for all services, also cable terminals, junction boxes, etc.



SEE THAT SQUARE HOLE



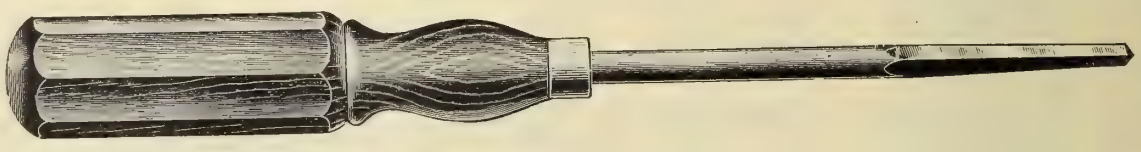
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Wood Screws

The advantages of this wood screw are many. The screw may be placed on the driver and driven at arms length, with one hand. It is impossible for the driver to slip out of the socket.
Drivers are made in a variety of suitable styles.
For electrical wiring and fixture work, etc. this type of screw is unrivalled.

Samples, prices and catalogue on request.

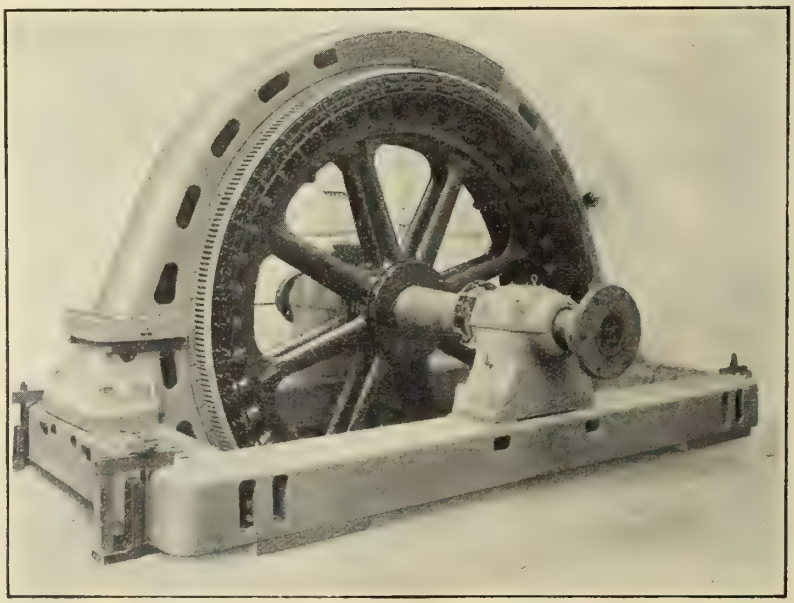
The P. L. Robertson Manufacturing Co., Ltd.
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VICKERS LIMITED
Patent Automatic Reversing Drive for Planing Machines

Complete Equipments for the electrical lighting and driving of machine shops, factories, etc.



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Motors of all types

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3000 K. W., 6600-volt, 164 R.P.M. 3-Phase Generator for the City of Winnipeg. Five Generators have been supplied

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The largest manufacturer of Cross Arms in the East.

INSULATOR TOP PINS made from Birch, Elm, Locust and Oak.

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SPECIAL PINS for HIGH VOLTAGE TRANSMISSION made from Locust and Oak, all kinds and sizes.

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Pemco Fixtures

"The Practical Fixture"

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Philadelphia Electric and Mfg. Company

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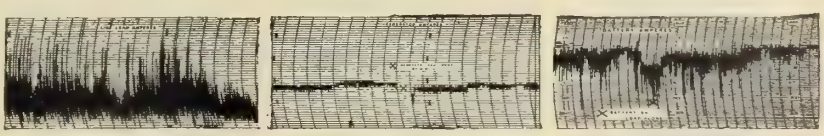
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A. H. Winter Joyner, Limited
76 Bay Street, Toronto

The D-P STORAGE BATTERY

RESULTS of **D-P** BATTERY & AUTOMATIC REVERSIBLE BOOSTER INSTALLED IN A CENTRAL POWER STATION.

REASONS WHY A BATTERY IS INSTALLED IN EVERY UP-TO-DATE PLANT:

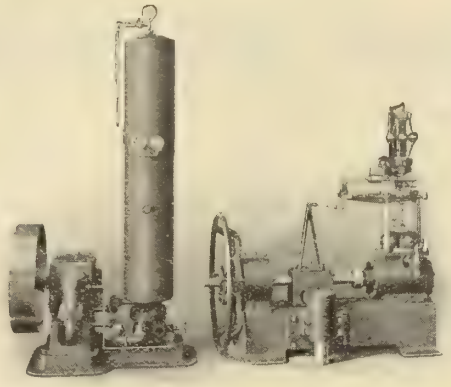
BECAUSE IT PROVIDES FOR A FLUCTUATING LOAD. IT IS ESSENTIAL TO ECONOMICAL WORKING. INCREASED LOAD IS SUPPLIED WITHOUT ENLARGING GENERATING PLANT. IT NEVER FAILS SUDDENLY : : UNDER LOAD. IT MEETS EMERGENCIES



Canadian Agency: Messrs. O'LEARY & Co., Montreal, Vancouver, Winnipeg.

THE D-P BATTERY CO., LTD., Bakewell, England.

ESTABLISHED 1888. CODE: A B C, 5th EDITION. CONTRACTORS TO ADMIRALTY AND WAR OFFICE.



THE GOVERNOR FOR YOUR CONDITIONS

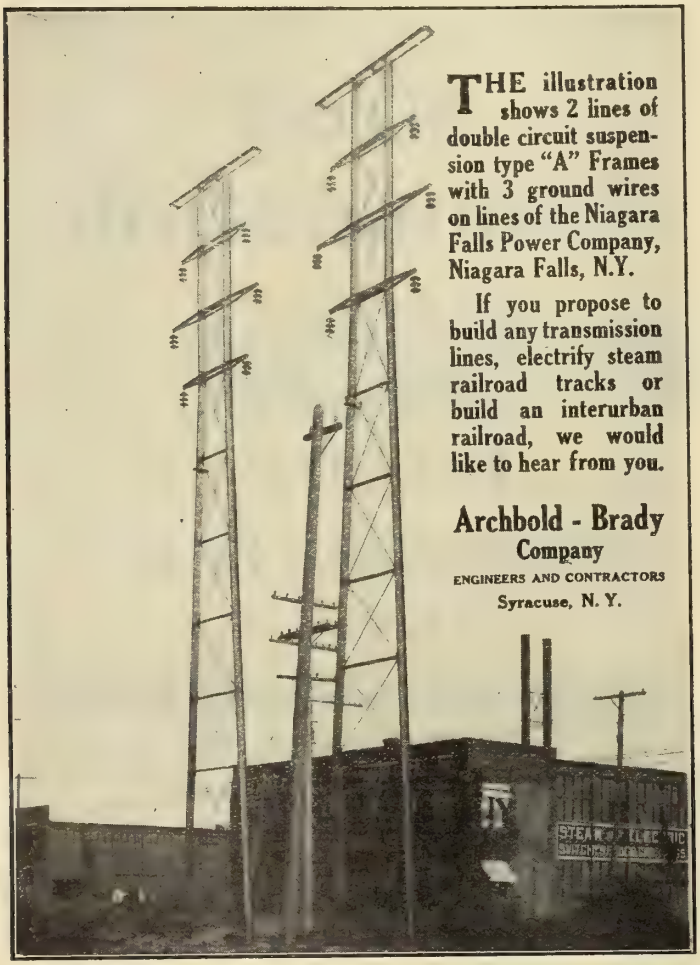
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The knowledge and the shop equipment which enable us to build the 250,000 ft. lb. governors for the Mississippi River Power Co. at Keokuk, are at the command of the purchaser of any of our governors.

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Pacific Coast Agents:—Pierson, Roeding & Co., 118 New Montgomery St., San Francisco, Cal.

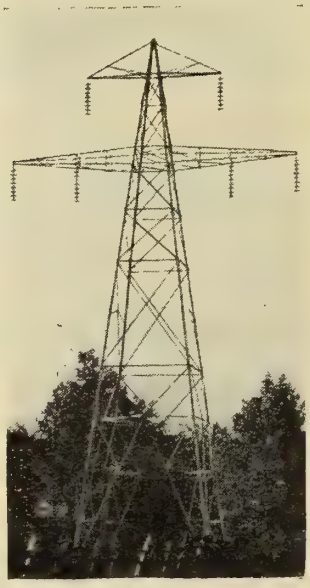


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If you propose to build any transmission lines, electrify steam railroad tracks or build an interurban railroad, we would like to hear from you.

Archbold - Brady Company
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Syracuse, N. Y.

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DOUBLE CIRCUIT TOWER
One of 3,300 Towers furnished for the 300 mile Transmission Line of the Hydro Electric Power Commission of Ontario Transmitting a 110,000 volt current from NIAGARA FALL to the principal cities of ONTARIO. The largest single order of Transmission Towers ever placed.

Hot Galvanized or Painted

Estimates furnished on application

The Canadian Bridge Co.

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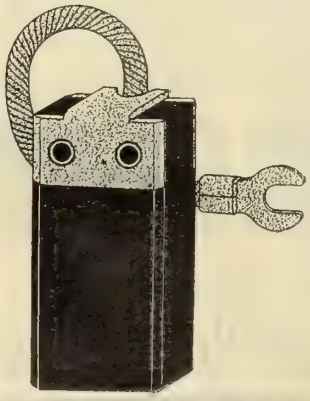
Walkerville, Ontario, Canada

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Structural Steel of all kinds

100 per cent Carbon Brush Efficiency



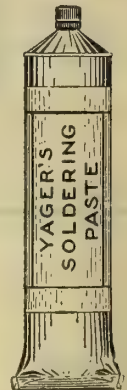
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SAVE Shut-down Losses
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Why experiment.
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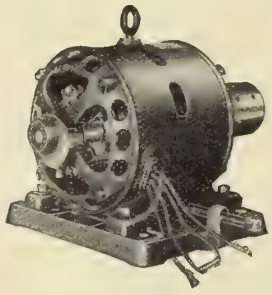
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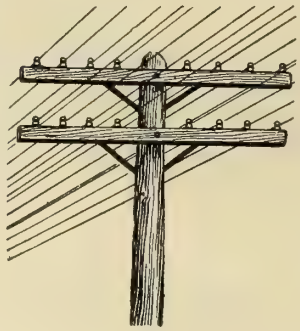
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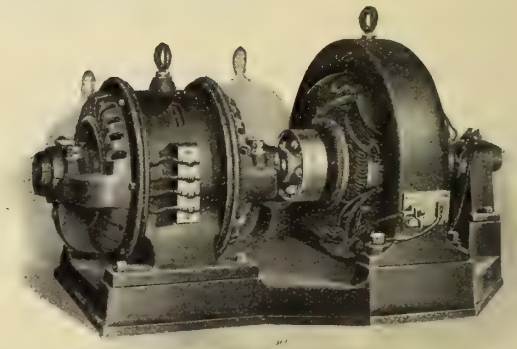
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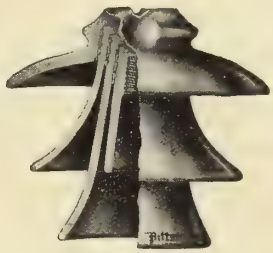
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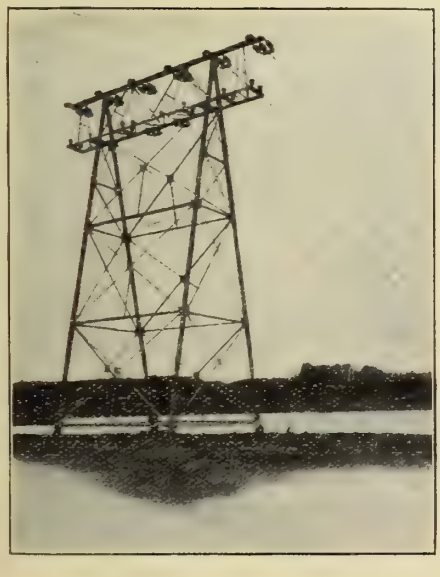
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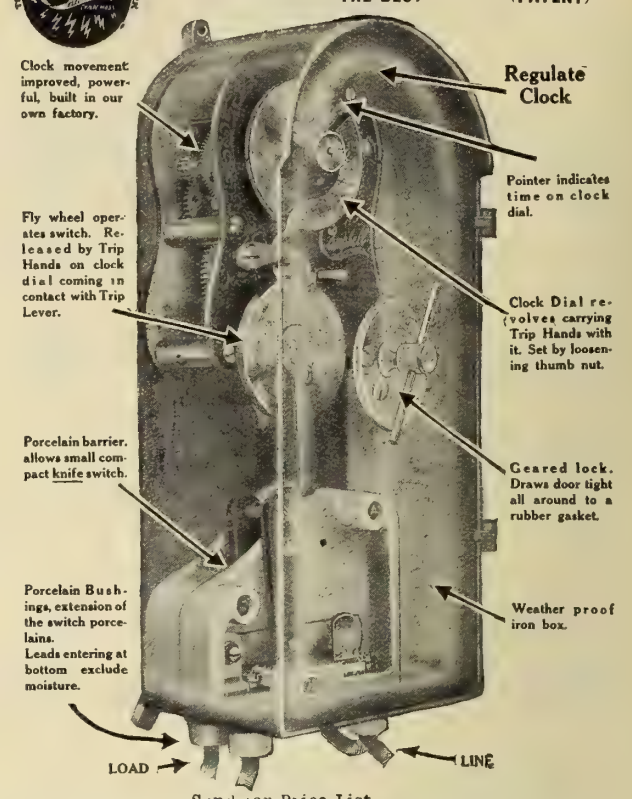
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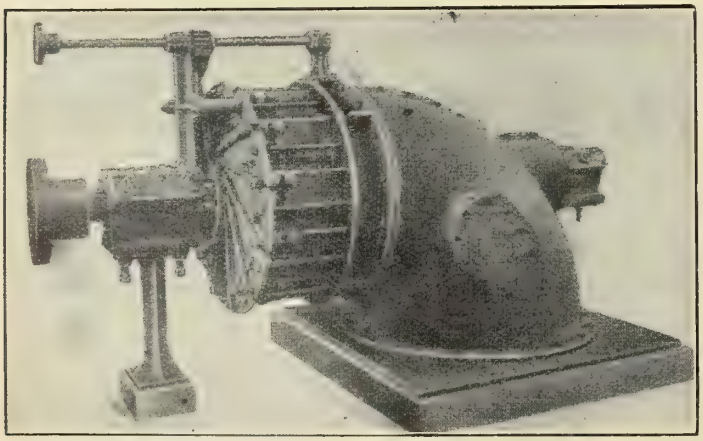
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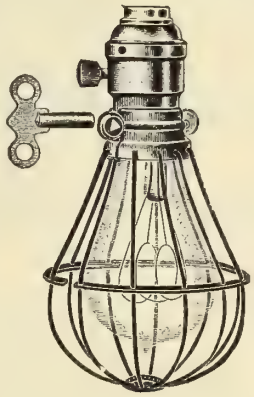
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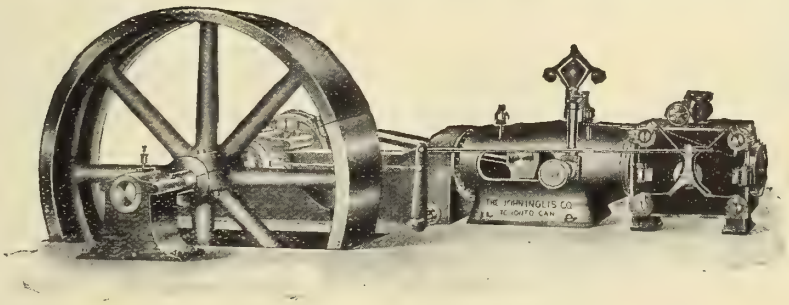
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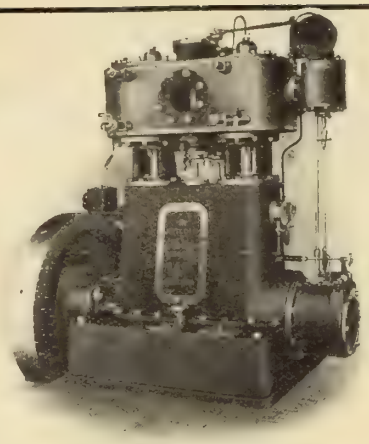
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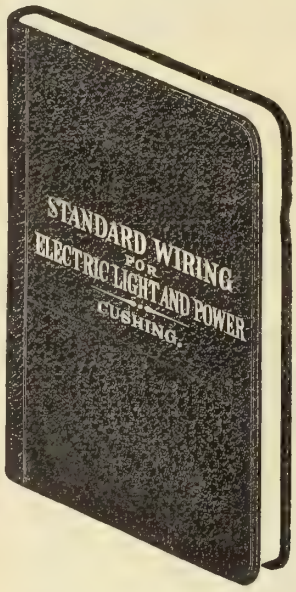
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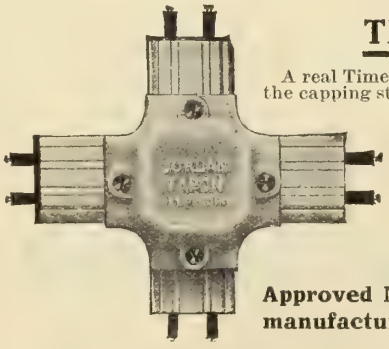
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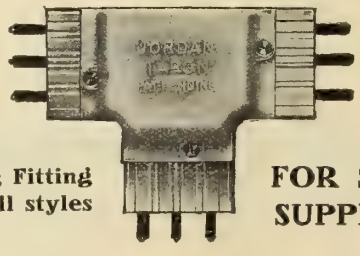
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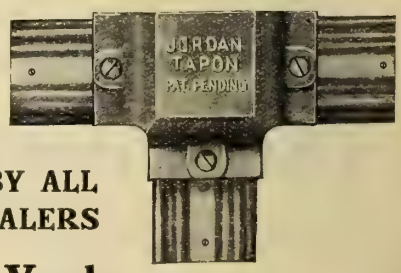
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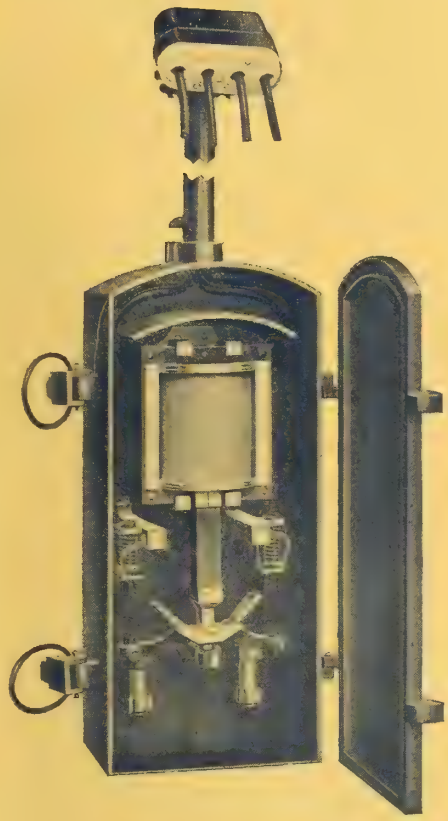




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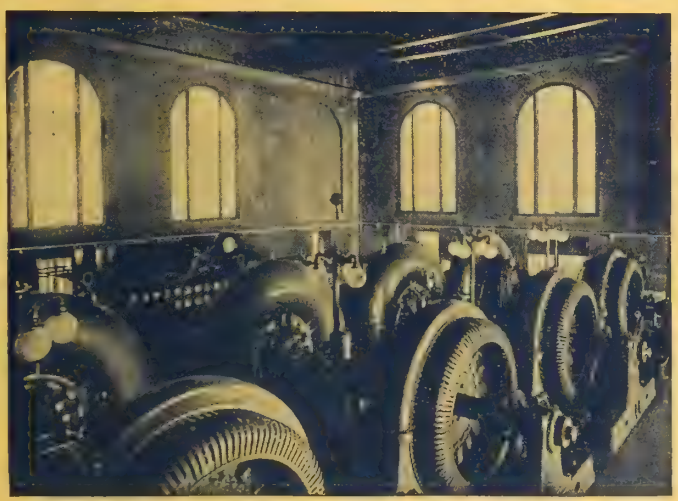
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Vol. XXII – No. 21 Toronto, November 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



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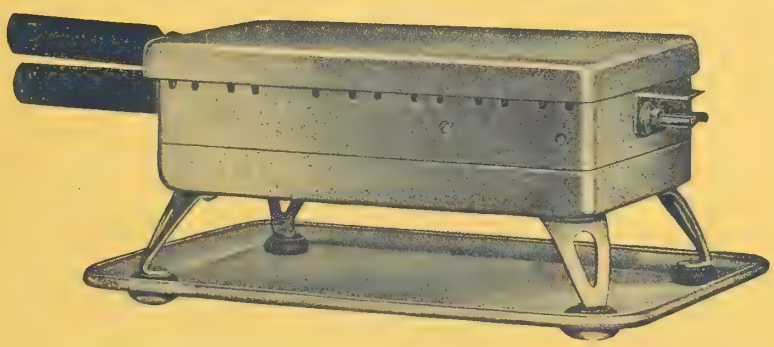
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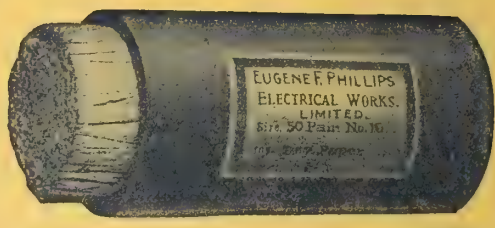
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PHILLIPS



Bare and Insulated Copper

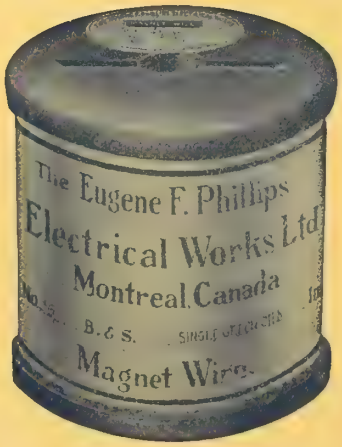
WIRES AND CABLES



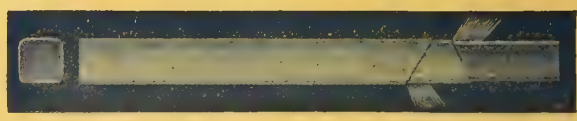
For Telephone, Telegraph, Lighting,
Power and Street Railway Equipment

Bare and Insulated Electric Wire and Cables for Aerial and Underground use

Railway, Feeder and Trolley Wire



Weatherproof Magnet and Rubber Covered Wires and Cables



Incandescent and Flexible Cords

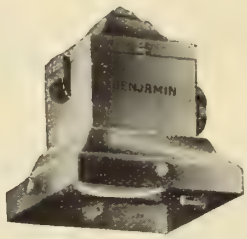
Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

Branches: Halifax, Toronto, Winnipeg, Vancouver



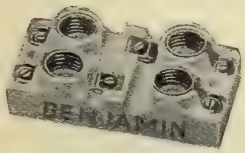
Cat. No. 59480
Key Socket



Cat. No. 463
Mission Socket



Cat. No. 59482
Keyless Socket



Cat. No. 62587
Plug Cutout

BENJAMIN

KEY SOCKETS
KEYLESS SOCKETS
PLUG CUTOUTS
ROSETTES
RECEPTACLES

Now Ready for Delivery

Write for Prices.

"BUY BENJAMIN"
Made in Canada
FROM YOUR JOBBER

Benjamin Electric Mfg. Co.
of Canada, Limited
11-17 Charlotte St. Toronto

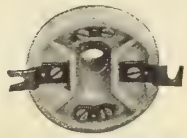


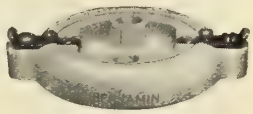
Cat. No. 61935
Plug Cutout





Cat. No. 298
Rosette





Cat. No. 870
Rosette



Cat. No. 1999
Rosette



Cat. No. 61317
Porcelain Key Socket



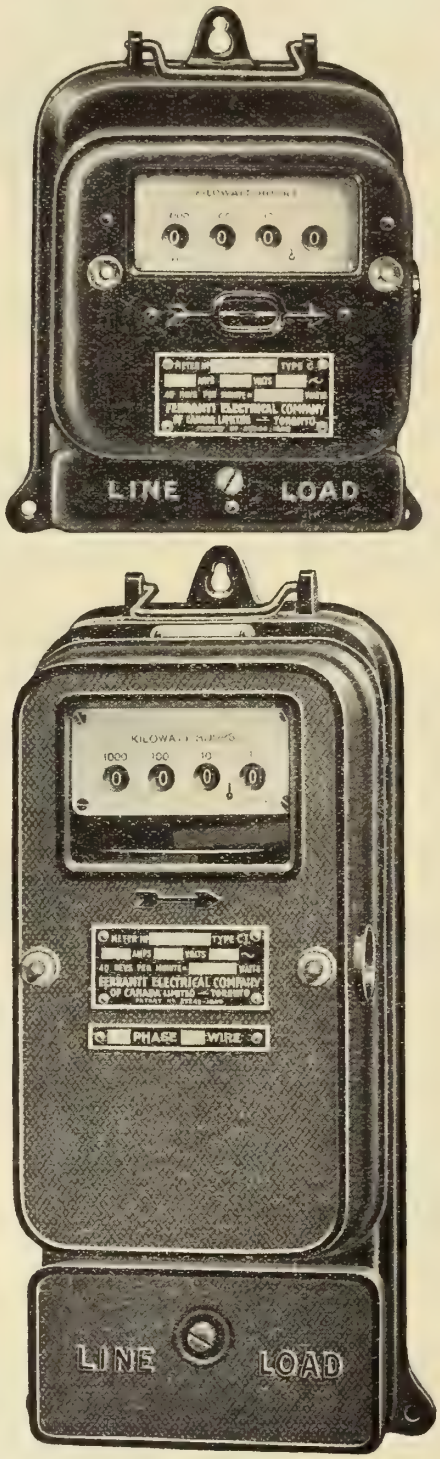
Cat. No. 9184
Receptacle



Cat. No. 59275
Cleat Receptacle



Cat. No. 68224
Receptacle



Ferranti Meters

on your light and power lines guarantee your profits at the end of each year.

Ferranti Improved Type "C" Meter, Single or Polyphase

These meters are guaranteed against mechanical and electrical defects for a term of three years and satisfy the most exacting customers under all conditions.

The Ferranti Meter has distinct improvements over all other makes.

Our prices are right. Send us your enquiries.

Ferranti Meters are assembled, tested and stocked at our warehouses at Toronto and Winnipeg.

Prompt shipments for standard meters can be made at all times.

The Ferranti Electrical Co., of Canada, Ltd.

90 Sherburne St., TORONTO 56 Albert St. WINNIPEG

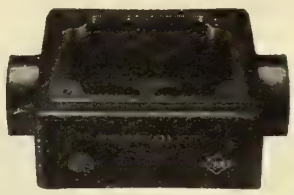
Railway Condulets



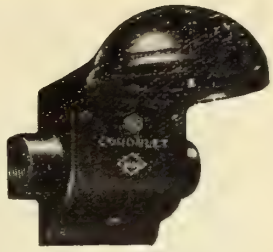
Type BLMC For Bracket Lamp Outlets. Takes Round Base Fittings.



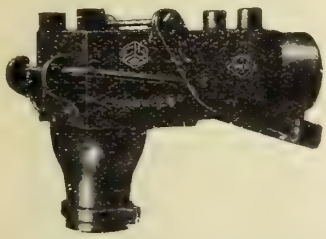
Type CLOC For use with Centre Ceiling Fittings.



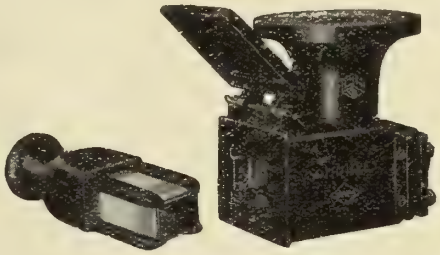
Type JRR—For use back of Mouldings with rectangular Base Fittings.



Type DSOC—For Deck Sill Outlets. Takes Round Base Fittings.



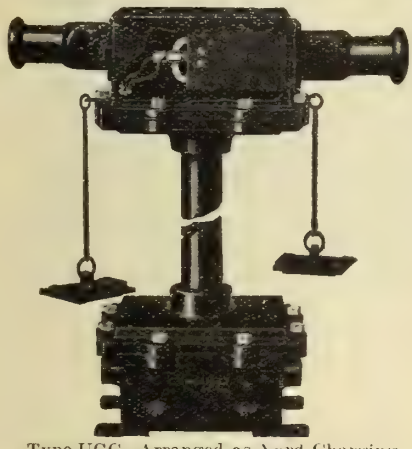
Type MD—Receptacle and Plug for Dynamo-Regular Connection.



Type BRHS With 100 Ampere Receptacle and Plug. Battery Charging Equipment for car.



Type PJCA—Medium Size Weatherproof Junction Box.

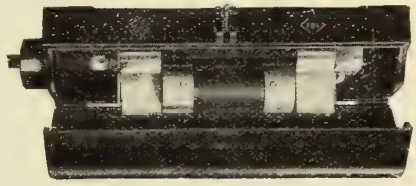


Type UGC –Arranged as Yard Charging Equipment for Underground Conduit System.

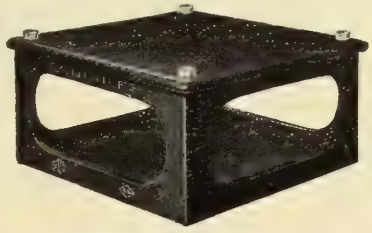


Two-Hub Side Plate for Type RS Condulet.

The Condulets shown here are only a few of the many types designed to simplify and improve conduit installations in railway cars, buildings and yards. Whatever the requirement, we have a Condulet to meet it.



Type FBL—Weather-proof Housing for 100 to 200 Ampere Battery Fuse.



Type RS—Detachable Sides, Weatherproof Junction Box.

You can secure detailed illustrations, descriptions and listings of all Railway Condulets by signing the attached coupon and mailing it to us.

Order Condulets from your dealer. If he does not stock them, write us.

Crouse-Hinds Co. of Canada, Ltd.

Main Office and Works:

Toronto, Ontario, Canada

Kindly send me free copy of Bulletin No. 101

Name .....

City ..... Prov. .....

2113

Across Canada with the
IMPERIAL WIRE & CABLE CO.
LIMITED

Toronto - MONTREAL - Winnipeg



Fifth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows the C. P. R. Hotel, Calgary

This building was wired with "Adanac" Rubber Isulated Wire

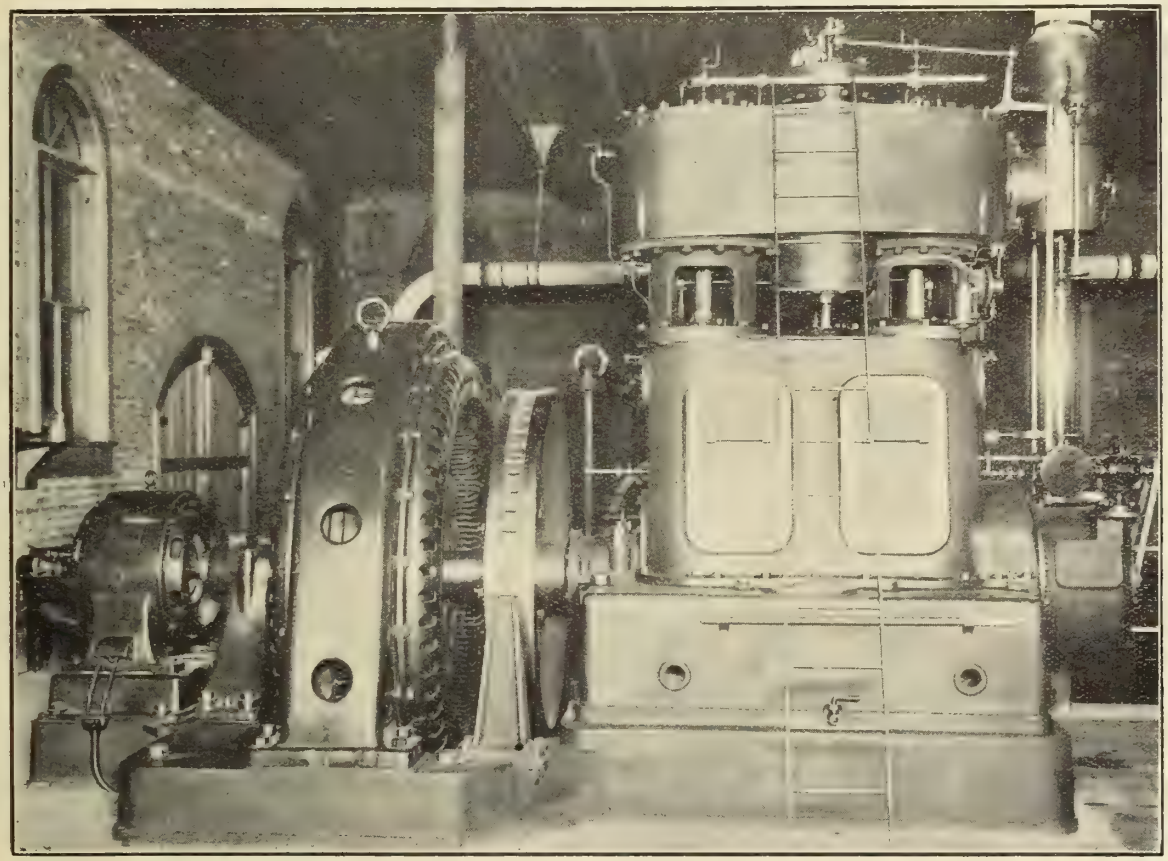
Architects and Engineers - - - E & W. S. Maxwell, Montreal
Electrical Contractors - Parker-Chase Electrical Construction Company, Calgary

Address enquiries to nearest office—Montreal—Toronto—Winnipeg

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Limited, Calgary and Vancouver.

"ADANAC," "IMPERIAL HIGRADE" and "30% PARA"

High Grade Electrical Apparatus



375 K.V.A. 2300 volt 2 phase 60 cycle 360 R.P.M., A.C. generator direct connected to a Belliss & Morcom high speed engine supplied to the corporation of Wetaskiwin, Alta.

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR

The General Electric Co., of Sweden

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers

GALVADUCT

LORICATED



Herald Building, Calgary
A "GALVADUCT" BUILDING

In buildings of every size, used for every purpose, in all parts of Canada, you will find the leading conduits of the continent—"Galvaduct" and "Loricated".

Your Jobber will supply you

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

"GALVADUCT"

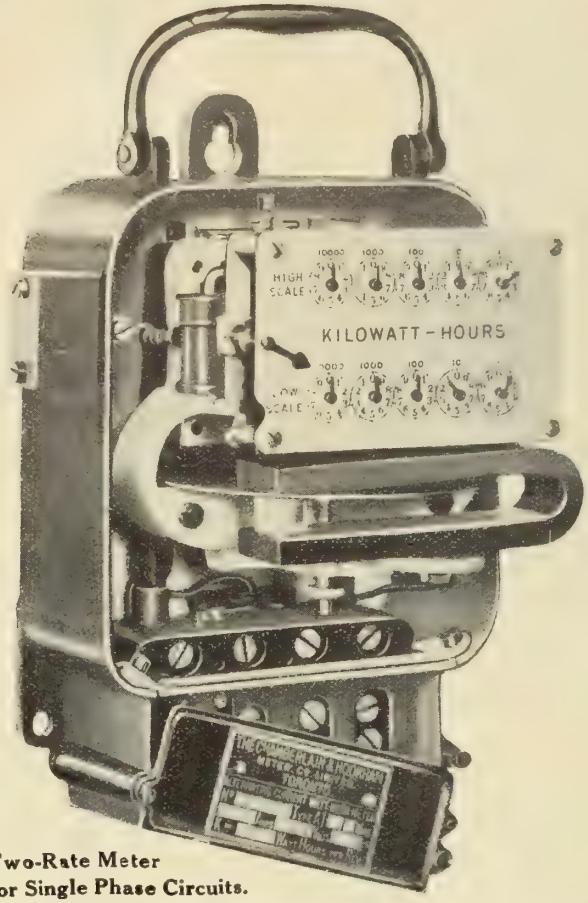
The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

Conduits Company Limited

Toronto - Montreal



Two-Rate Meter
for Single Phase Circuits.

C & H Two-Rate Meters

You are largely dependent upon your meters each year for the profits from your service. They are the guardians of your revenue and you are constantly relying upon their accuracy in recording each passing watt. Can you afford to be indifferent about the efficiency of these important instruments?

C & H Meters are as accurate and efficient as high-class mechanical engineering and workmanship can make them. The satisfaction they have given in the past in Canada is your guarantee when buying.

We have a good supply of single, polyphase and two-rate meters at our warerooms from which to make prompt shipments. Try us for a rush order.

Chamberlain & Hookham Meter Co., Ltd.
120 Richmond West Toronto, Ont.

Eastern Representatives
Spencer & Aspinall, 617 New Birks Bldg., Montreal, Que.

—: STOP :—

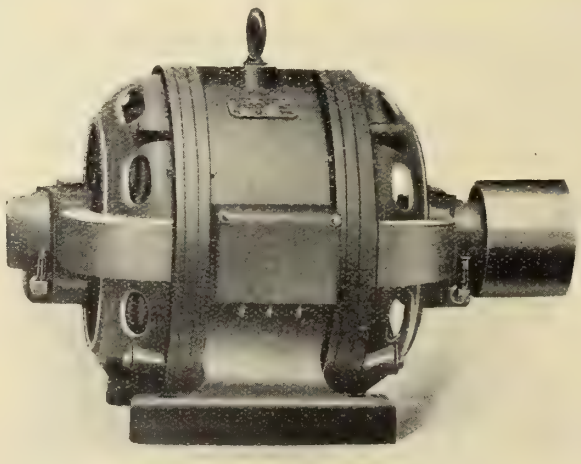
That's what you must do to read the following remarks, **BUT** it's what the **UNION** Motor **NEVER** does when once started and the current is kept on.

Learn all about it by asking for our Bulletins.

Canadian Union Electric Co., Limited

Head Office: 130 Wellington St., West, Toronto

Also at 9 St. Nicholas St., Montreal



Pattern H. D. Squirrel Cage Motor.

Represented in Winnipeg by:

The Mainer Electric Co., Limited

61-63 Albert St.

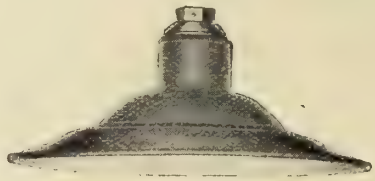

There'll be
Only One Xmas
This Year
See to it that you get your share of the Xmas Business.
Make your window work. Trim it with Xmas present suggestions — Household Appliances — Colored Electric Lights— Eveready Flashlights!
We are prepared to help you.
At each of our houses we carry a complete stock of all these lines.
We guarantee prompt shipments.
THE Northern Electric
AND MANUFACTURING CO. LIMITED
Montreal Halifax Toronto Winnipeg Regina
Calgary Edmonton Vancouver Victoria
SANTA CLAUS
ELECTRIC CANDLES



No. B A D 500
with holder and Mogul Socket No. 622



D E D 100



R E M M 60

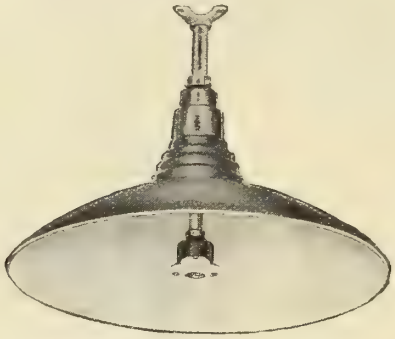


R E L 500

HOLOPHANE-D'OLIER Metal Reflectors

Cleanezy-Aluminum and Porcelain-Enamel Finishes

The Line that Establishes the Standard for Factory Lighting



Solid extension R Type Holder
Easy to wire attachment

Have You Received Our New Metal Reflector Catalogue?



R E D 500

The new Cleanezy-Aluminum Finish—reaches the highest point in metal reflector perfection.

"Hard to Soil, Easy to Clean"

Made for every size of Mazda Lamp—six distinct holders—all angles and distributions—they solve every factory-lighting problem.



A E 250

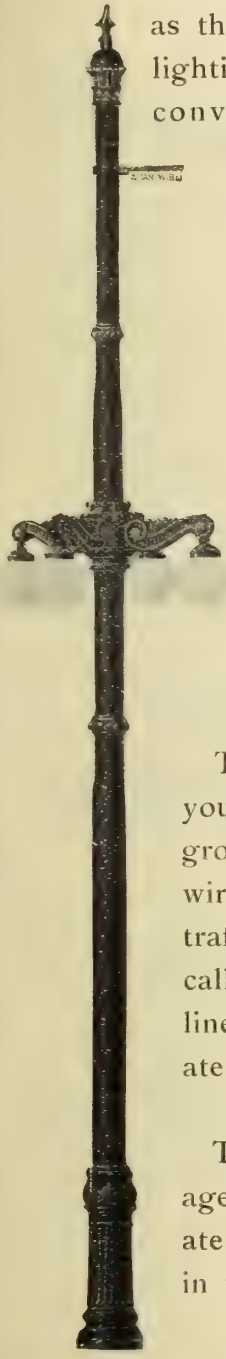
The
Holophane Company
Limited
Toronto, Canada

Holophane Glass a Toronto Product



A I 250

Use the Railway's Trolley Poles



as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

ERECO Combination Railway Lighting Pole Fixtures

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

Design No. 10015.

Electric Railway Equipment Co.

Cincinnati, Ohio

Designers **Manufacturers**

Canadian Representatives:

Dawson & Co., Limited, Montreal, Winnipeg

N. Y. Office, 30 Church St., Hudson Terminal Bldg.



Butler Bros. *Chicago*

Another Mammoth Firm Installs the Eye Comfort Lighting System.

Indirect Illumination is the light of the future. It is here to stay.

Many contractors and supply men realize this opportunity and are making big profits as a result. Central Stations are quick to grasp its advantages.

Which is then the most efficient and most economical system? Which is scientifically designed by engineers to produce perfect lighting, and which has been marketed merely to get some of the profits to be made by selling unscientific and inefficient equipment to a public who has not the knowledge to judge intelligently?

Which system shall **you** advocate?

We say to you:—

That the Eye Comfort Lighting System was installed by the Curtis Publishing Company at Philadelphia (1,000 fixtures) after a sixteen months' investigation. Armour & Company equipped their entire five-storey building (900 fixtures) after eight months of testing. Butler Brothers, shown above, light their offices and sample rooms (1,700 fixtures). Boys High School, New Orleans, is installing 1,200 fixtures. The world's largest men's wear store, The Hub, Chicago, is lighted by it throughout (eight stories). The International Harvester Co. has installed 350 fixtures; Sears Roebuck & Co., 700; Montgomery, Ward & Co., 250; Goodyear Tire & Rubber Co., 385 fixtures at Akron, besides thirty branches; and so on.

Millions of capital says "it is the best system, barring none!" This after exhaustive tests costing thousands and much time.

We cannot offer you stronger proof. We know of no more positive proof you can give your customers. Acquaint yourself with the Eye Comfort Lighting System. It is sold by Canadian jobbers. Ask for our data book and catalogue.

National X-Ray Reflector Co.

General Offices:
225 W. Jackson Blvd.
Chicago, Ill.

New York Office:
Eye Comfort Lighting Shop
14 W. 33rd. St.

GMUR & COMPANY, LIMITED

Aarau, Switzerland

CAPITAL $ 200,000

Carbon Filaments in all Shapes and Sizes **Flexible Metal Filament "Uranit"**

Drawn Light Wire "Uranit" **Supports** Carbon, "Uranit" Alloy Molybdenum, Molybdenum Alloy

Tungsten-Molybdenum Wire in all Sizes

LARGEST SPECIAL FACTORY FOR LAMP FILAMENTS

Goods manufactured by

The Canada Metal Co., Limited

Have a Reputation for Quality

IMPERIAL SOLDERING PASTE

Absolutely the finest soldering paste on the market.

IN TINS
2 oz.
4 oz.



IN TINS
8 oz.
16 oz.

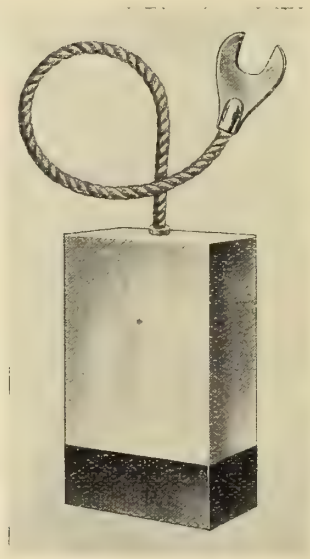
A Sample Order will convince you that we have reason to be proud of the goods we manufacture.

Manufactured by

The CANADA METAL CO., LIMITED

TORONTO

Branch Factories: MONTREAL and WINNIPEG



Special Motor and Dynamo Brushes To Order

We are prepared to make with accuracy and promptness any special sizes in carbon brushes.

Our B.B. special carbon brush is of the highest class. It is so blended and tempered that it has an extremely long life and the lubrication is positive through the life of the brush.

Get our catalogue containing prices.

Send us your inquiries for any style of Gauze—Carbon or Magneto Brushes.

Becker Brothers 561 W. Washington St. CHICAGO, ILLINOIS.

Yager's Soldering Fluxes

4 Forms—1 Result—The Perfect Joint

Efficiency is the word. Let us co-operate with you to increase the efficiency of your service. Use Yager's Fluxes in any of the four convenient forms — Salts—Stick—Paste — Fluid, to produce joints which will not fail you at the critical moment. No acid in any of them. They make the perfect electrical joint.

Write now for sample and discount.



ALEX. R. BENSON COMPANY

HUDSON, N. Y.

SIMPLEX QUALITY

The Year-Round Merits of Simplex Products make our Holiday Offerings Self-Sellers.

You can't well overstock on Simplex goods—they are always first choice.

We have greatly enlarged our popular Simplex line with new offerings of specially attractive lamp socket devices. They give you a nice profit margin, and have a strong selling appeal. Special holiday packing.
Descriptive matter is in the printer's hands and will be ready for mailing shortly.

SIMPLEX ELECTRIC HEATING CO.

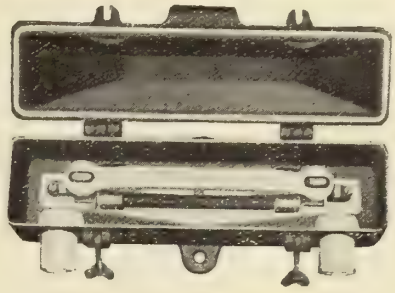
Mfrs. of Everything for Electric Heating and Cooking

BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.

SAN FRANCISCO, 612 Howard St.

In the Plant—
On the Line—
In the Sub-Station—



Protect your transformers, arc lighting circuits and branch circuits both underground and overhead with

"NOARK" Primary Boxes

They were designed especially to overcome all known defects in existing methods of transformer protection. Lighting and Power Companies agree that this object has been accomplished. Among the details which particularly deserve notice is the insulation. Unusually high factors of safety are employed in figuring insulation and leakage surface dimensions. The husky porcelain fuse blocks and carrier handles are also worth noting, as are also the patent lead-sealed porcelain bushings. These boxes are made in many types to suit varying conditions, and special boxes can be furnished to meet unusual requirements.

Our nearest Branch will gladly take the matter up with you.

Write for Catalogue 406.

The Canadian H. W. Johns-Manville Co., Limited

Manufacturers of Asbestos and Magnesia Products — ASBESTOS — **Asbestos Roofings, Packings Electrical Supplies, Etc.**

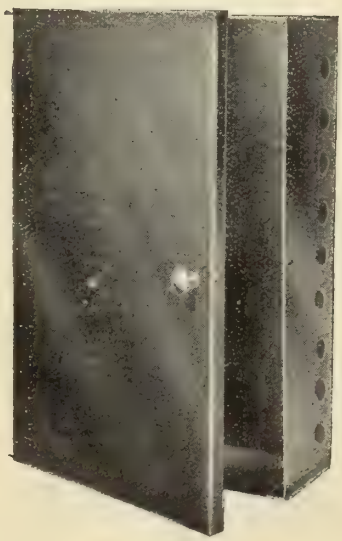
TORONTO MONTREAL WINNIPEG VANCOUVER

1853

"DEVOE" One Piece Formed Boxes

SAY: Do you know that "DEVOE" one Piece formed boxes are made in Canada, built of the best "ENGLISH" steel and formed from one piece of metal. Covers are bent on all four sides making them absolutely dust proof.

Send for our sample box today (its free)



Buy

"DEVOE"

One Piece Formed Boxes

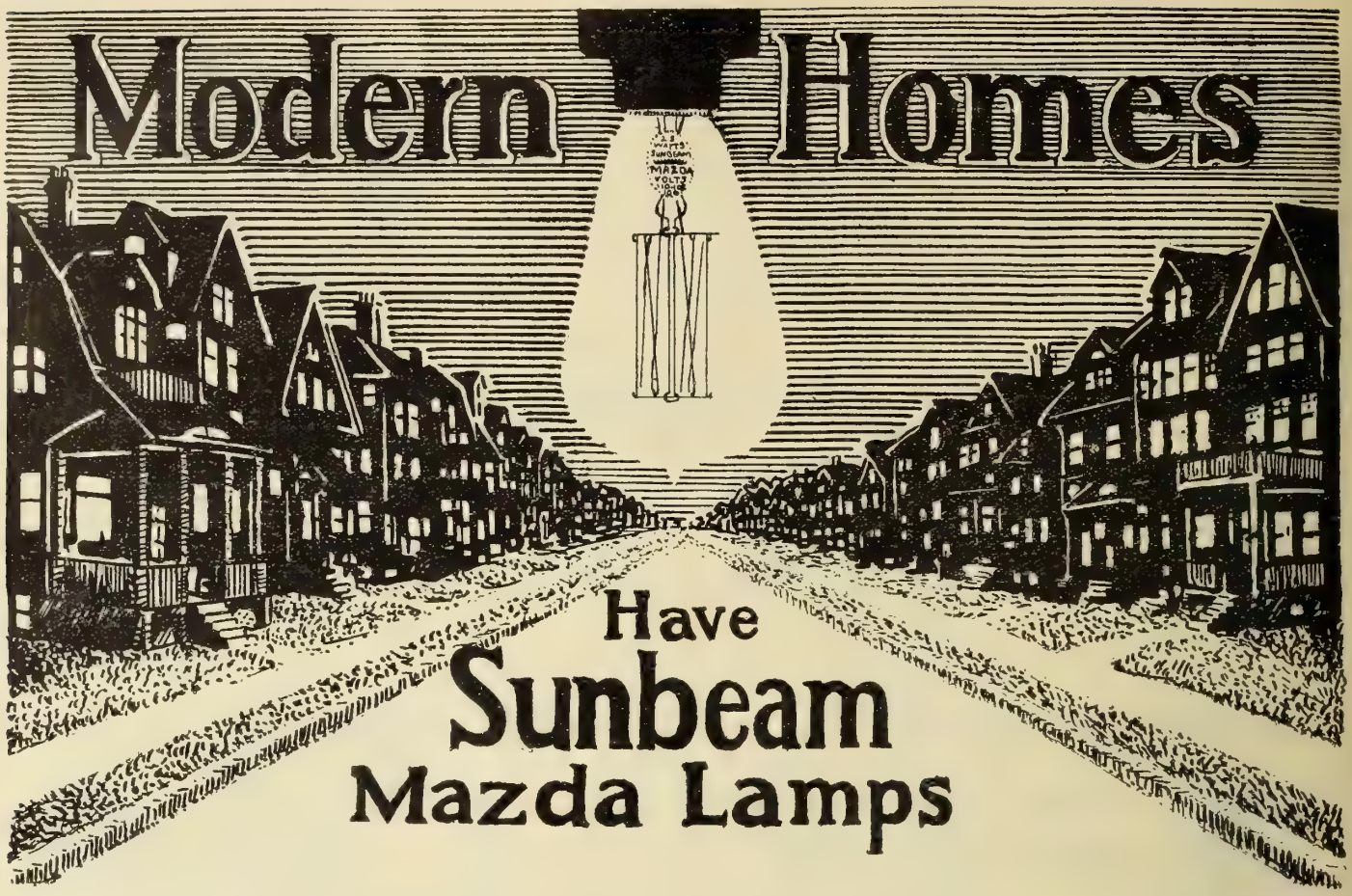
and save

"MONEY"

Write for Bulletin No. 2 on Boxes

The Devoe Electric Switch Company

Office and Factory: No. 157 Craig St. West, Montreal



You Should Sell Them

The lamps selected for most modern homes, office and other buildings are the famous Sunbeam Mazda Lamps.

They are strong in construction and produce a brilliant and steady light. Three times as much light as a carbon lamp.

They are made in every size, style and capacity and for every purpose from the pocket flash lamp to high candle power units for large area lighting.

You should sell Sunbeam Mazda Lamps.

Your jobber can supply you

Canadian Sunbeam Lamp Co.

Limited

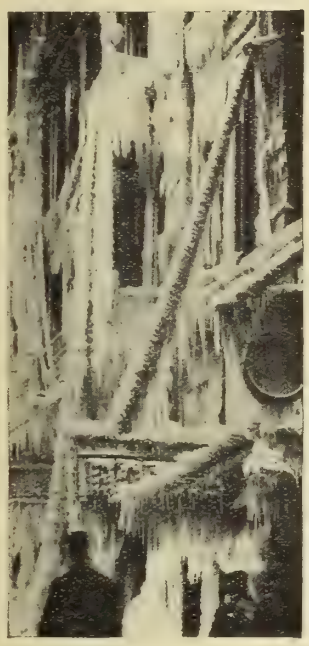
Main Office and Factory: TORONTO

BRANCH WAREHOUSES:

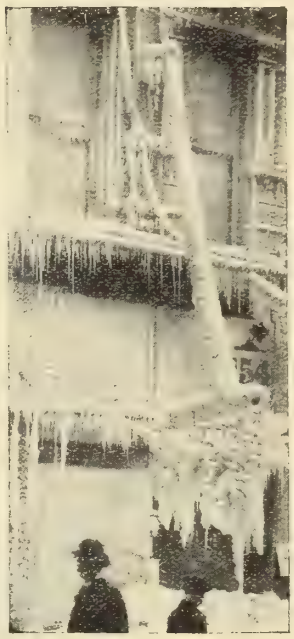
MONTREAL **WINNIPEG** **CALGARY** **VANCOUVER**



The Weather Won't Hurt Them



It takes more than fire and water to put a Federal Electric Sign out of commission—they are built to stand adverse conditions. And they will keep their attractive appearance for a lifetime. They are made to **last.**



Federal Signs— Indestructible

Careful planning and construction has produced in the Federal, an Electric Sign that is almost indestructible. From the time the galvanized channel iron frame is started until the last wiring connection is made, every care is taken to obtain the best materials and perfect workmanship. The sectional Letters are stamped from sheet steel and are porcelain enamelled, inside and out. The colors, a brilliant white upon a royal blue background, afford the greatest contrast and make a sign that is effective by day as well as by night.

Central Stations—Write for Bulletin 27111

Federal Sectional Signs are sold F.O.B., Factory, Hamilton, Ontario

Federal Sign System (Electric)

Lake and Desplaines Sts.,

CHICAGO, ILLINOIS.

CONSOLIDATED TUNGSTOLIERS



¶ Shipped to you in cartons, completely wired, and ready to instal.

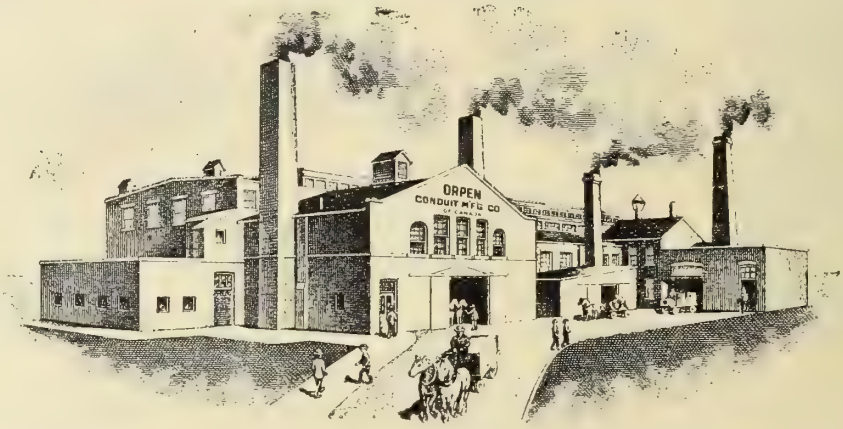
¶ No chance for missing parts.

¶ Write for your copy of Bulletin 150A, full details given.

The Tungstolier Company of Canada Limited

212 King Street West, TORONTO

The home of XCELADUCT and ORPENITE CONDUITS



Queen and Dufferin Streets TORONTO

"XCELADUCT"

"Xceladuct" is a high grade of galvanized conduit made of easy-bending spellarized steel tubing, doubly protected against rust by copper plating and zinc coating. Every length is made up with clean threads and smooth enameled interior, allowing easy and rapid fishing.

INTERIOR CONDUITS

ORPEN CONDUIT MANUFACTURING CO. OF CANADA
MANUFACTURERS OF
XCELADUCT
ORPENITE
CONDUITS
HEAD OFFICE
TORONTO ONTARIO

Let us send Prices and Samples

"ORPENITE CONDUITS"

"Orpenite" Enameled Conduit is made of easy-bending spellarized steel tubing which is protected against rust and proof against all temperature conditions by coatings of specially prepared enamel. Each length presents clean threads and a smooth interior permitting of easy and rapid fishing.

THE ORPEN CONDUIT MANUFACTURING COMPANY of CANADA

ORONTO MONTREAL

G. M. Gest

Conduit
Engineer & Contractor

503 Power Building, Montreal, Can.



NEWTYPE
BERGMANN
LAMPS

(*Tungsten Filament*)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

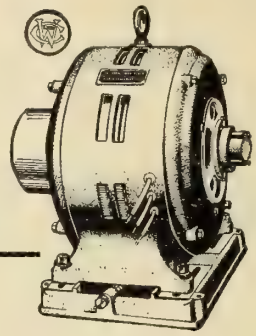
EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO., LIMITED

329 CRAIG STREET WEST
MONTREAL, P.Q.

LIVE AGENTS WANTED ALL OVER CANADA

We have a special line of ball-bearing motors designed to eliminate troubles due to seizing through dust and grit or through lack of oil, freezing in cold weather etc.



These motors have the smallest possible air gap and highest possible efficiency. Large stock of motors of all sizes for 25 cycle current carried in Toronto, ready for immediate shipment Over 50,000 H. P. in satisfactory operation, from Coast to Coast.

Standard Protected Type Squirrel Cage Induction Motor

Direct Current Motors

We also handle alternating current elevator motors, variable speed motors for driving printing presses, refrigerating machinery, etc. also small single phase motors with high starting torque.

Enquiries solicited for all classes of Electrical Machinery and apparatus.

Single and Polyphase

Manufactured from the best and most dependable material by the highest grade of English workmanship.

We can Supply any special design of motor that is particularly adapted to any class of work.

CHAPMAN & WALKER LIMITED

TORONTO - CANADA

Protection from Lightning Troubles

(MOSCIKI SYSTEM)

The following list of users of the Mosciki System of Lightning Protection speaks for itself:

Victoria Falls and Transval Power Co.
Shanghai Municipality.
Melbourne Electric Supply Co.
Cleveland and Durham Power Co.
St. John Del. Key Co. Brazil.
Societa Dergano.
Sociedad Espanola, Madrid
Societa Electrica Suburbana, Milan. &c.

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage— is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

The MOSCIKI System of Lightning Protection fulfils this condition absolutely — its principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

Mosciki Lightning Arrester



Exclusive Canadian Agents:

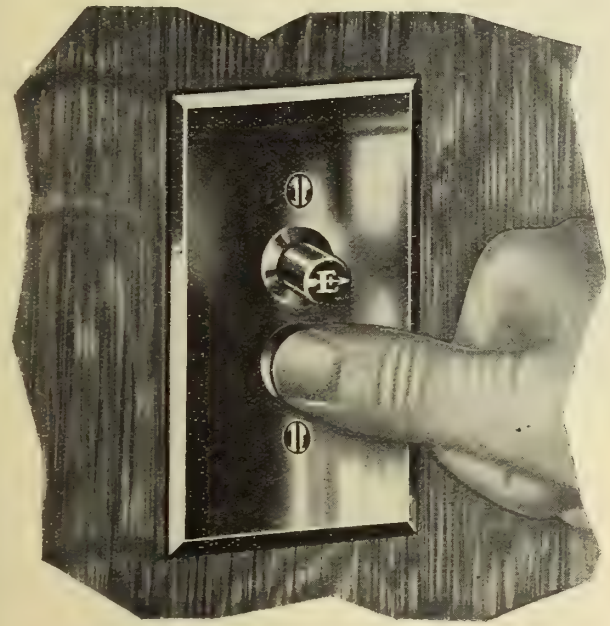
CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS

116-118 Richmond Street W., TORONTO

THE SWITCH THAT CONTROLS THE LIGHTS



is an important factor in any installation.



You can depend upon

"ARROW E" Push Button Switches

to give real service

They are
STRONG and RUGGED,
OPERATE SMOOTHLY and QUIETLY.

Built for
LONG LIFE and RESERVE CAPACITY.

You will find them installed in many prominent buildings throughout Canada.

"Quality plus Service"

Made right and guaranteed to be right.

Use the new "ARROW E" catalog

Canadian Distributors:

THE Northern-Electric AND MANUFACTURING CO. LIMITED

MONTREAL
REGINA
HALIFAX
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VANCOUVER

For unerring accuracy—



Metal Case Type "K"

PACKARD METERS

Acknowledged by leading electrical engineers to be the standard for use on all power and light circuits.

The many improvements which we have recently made in "Packard" meters, without a doubt make them the most accurate and reliable meter on the market.

Don't take chances with your revenue and with the service to your customers by installing an inferior meter. Get the best—the **"PACKARD."**

Single and Polyphase types in metal or glass cases for circuits of all descriptions.

Large Stock Carried at:

St. Catharines and Winnipeg St. John Railway Co., St. John, N. B. General Supplies, Limited, Calgary, Alta. Rudel-Belnap Machinery Co., Canadian Express Bldg., Montreal, P. Q.

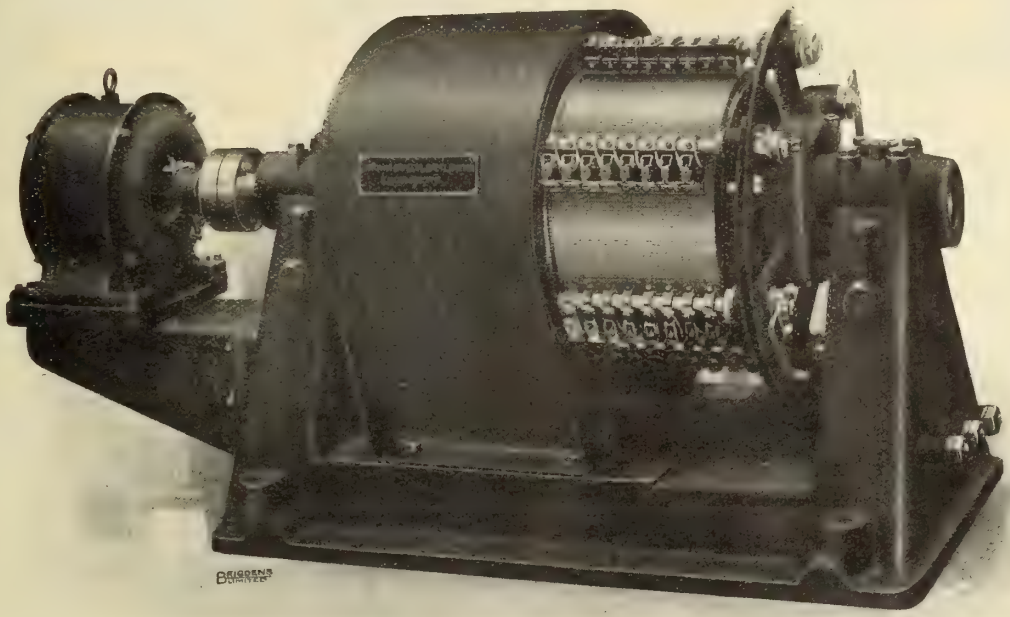
The Packard Electric Company, Limited

Factory at ST. CATHARINES, ONT.

General Sales Office
Traders Bank Bldg., TORONTO

N. W. Office and Warerooms
WINNIPEG

THE BROWN BOVERI PHASE COMPENSATOR



Phase Compensator for use with Induction Motors.

A high POWER FACTOR results in

Better Regulation
Smaller Line Losses
Less Capital Outlay.

Brown Boveri Compensators make these features possible by raising the power factor of induction motors to 100 per cent. or to a leading value. The combination of induction motor and compensator offers the advantages of both asynchronous and synchronous machines without their disadvantages.

Your power factor trouble may be one we can remedy.

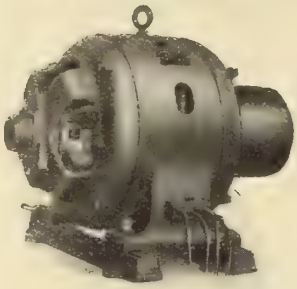
Mail particulars to

THE CANADIAN CROCKER-WHEELER CO., LIMITED

MANUFACTURERS AND ELECTRICAL ENGINEERS

HEAD OFFICE AND WORKS: St. Catharines. DISTRICT OFFICES: Montreal. Toronto. Vancouver.

"Always on the Job"



perfectly describes the operation of Wagner Single-Phase motors.

The reasons are:

Abundance of active material.

Rugged frame construction.

Solid End Plates in all sizes.

Massive bearings.

Simplicity of operation: merely close the switch.

Built to last: (fifteen) years' operation without repairs and still in service is report on some of our oldest motors of this type.

Write for new Single-Phase bulletin No. 10113, describing the ONLY complete line of single-phase motors.

Wagner Electric Manufacturing Company
of Canada Limited - Montreal

2226

Eversheds Meggers and Bridge-Meggers

In stock with their Sole Canadian Agents

New Catalogue on application.

R. H. NICHOLS

Dineen Bldg., - TORONTO

Representatives in
Montreal, Ottawa and Winnipeg

PUT $\frac{ONE}{E}$ = "STUNG"

Put One Over the Engineer

The equation some of our competitors have adopted. Don't give him what he specifies, omit all the up-to-date features. Emphasize some unimportant detail, and get away with it if you can.

To avoid being "stung," specify I-T-E and stick to it.

THE CUTTER COMPANY, Philadelphia

The QUESTION of the DAY

With Street Railway men is the Fare Box—a system which has gained favour wherever tried. The safest box made is the Cleveland. All nuts, screws, and bolts are inserted from the inside, and the cash box automatically locks itself when being removed.



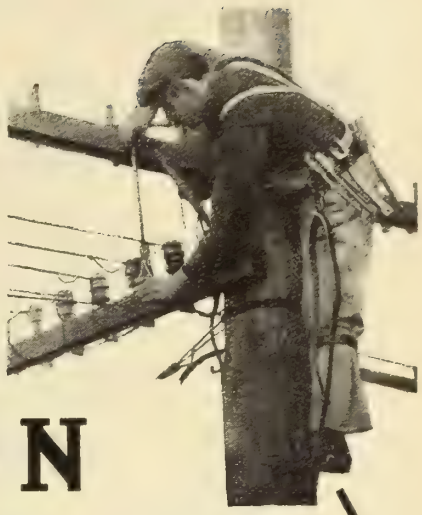
The Cleveland

Fare Box is Light, Strong, Durable and Safe. It is proof against theft, and has been adopted by many of the Street Railway Companies in America and Canada.

Cleveland Fare Box Co.

5310 St. Clair Ave., Cleveland, Ohio

There's a Whole Lot in Having the Right Kind of Tools to Work With!



KLEIN TOOLS

are the right kind in every sense of the word. In the first place they are manufactured by a concern with half a century of tool-making experience and equitable business dealings back of it. In the second place, they represent the applied knowledge resulting from years of practical contact with the precise requirements of the lineman, electrician and electrical worker.

Order **"KLEIN TOOLS"** and you'll be sure of what you're getting.

Write for Illustrated Catalog

MATHIAS KLEIN & SONS

Canal Station 59 - - CHICAGO



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
Second, because it is the only renewable fuse that is uniformly rated.
Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

Two Economy Renewal Elements are now furnished without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

Economy Fuse & Mfg. Co. of Canada, Limited

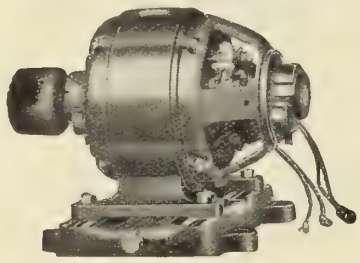
Herald Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.

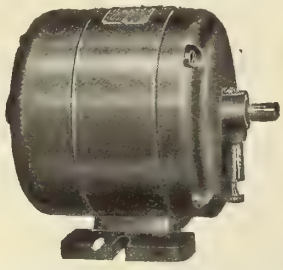
Fractional Horse Power Motors

Not toys, but real, efficient, reliable power producers for actual service

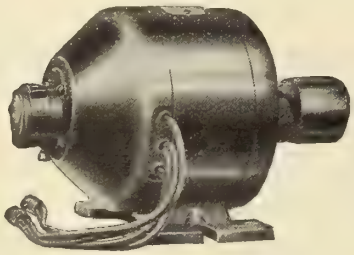
TYPE DSD MOTORS



Type DSD—1/2H.P.—1700 R.P.M.—115 Volt Direct Current Motor



Type DSD—1/6 H.P.—1700 R.P.M.—110 Volt Totally Enclosed Direct Current Motor

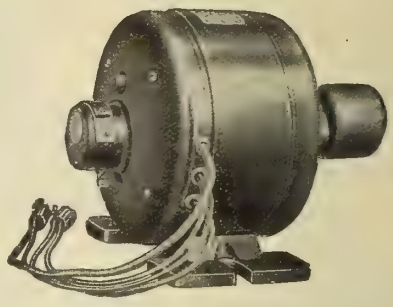


Type DSD—1/4H.P.—1700 R.P.M.—220 Volt Totally Enclosed Direct Current Motor

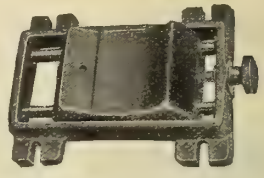
WE are called upon continually to supply special motors for applications of all kinds. Sometimes its light weight, or noiselessness, or unusual size or shape, the ability to work equally well on A.C. or D.C. or perhaps its extraordinary starting torque or overload capacity that is required.

If one of our standard motors will not fill your requirements we will gladly solve any application you may require.

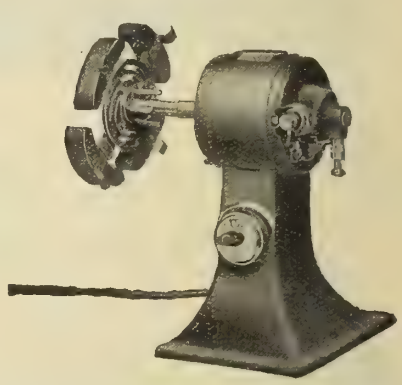
If you have a machine or especially if you market a product and wish to equip it with the best fractional horsepower drive, our nearest district office will gladly furnish descriptive literature and prices.



Type DSS—1/4H.P.—1800 R.P.M.—110 Volt Totally Enclosed Single-Phase Motor



Sliding Base. May be Substituted for Slotted Foot



Hat Cleaner Driven by 1/15 H.P. Direct Current Drawn Shell Motor

CANADIAN GENERAL ELECTRIC CO.

LIMITED

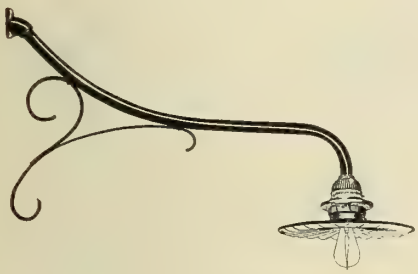
Head Office: TORONTO

Montreal Halifax Ottawa Fort William Winnipeg Calgary Vancouver Victoria
Cobalt Regina Edmonton Porcupine Saskatoon Nelson Prince Rupert

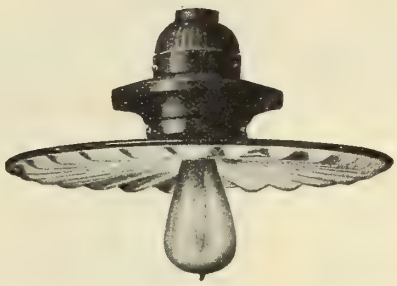
C. G. E. Wheeler "1914"

Series Mazda Street Fixtures

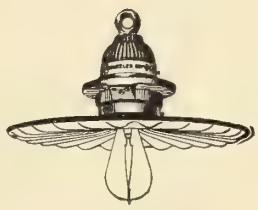
With Porcelain Receptacle Head



No. 1924
With Bracket "C"



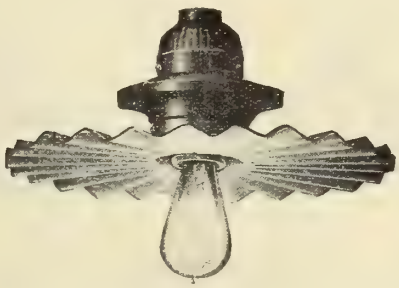
No. 1921
Body only with Hooded Reflector.



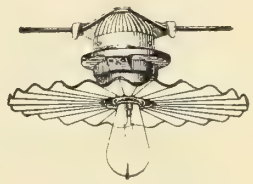
No. 1929
With Suspension Loop.



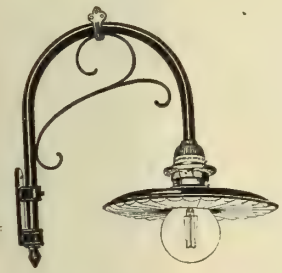
No. 1956
With Bracket "B"



No. 1931
Body only with Un-hooded Reflector.



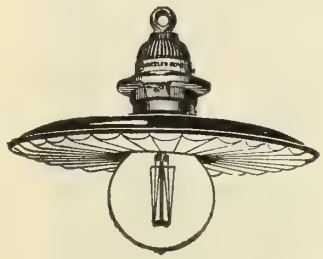
No. 1941
With Center Span Suspension.



No. 1995
With Bracket "F"



No. 1991
Body only with 23 inch Hooded Reflector for 200 c. p. and 350 c. p. lamps.



No. 1999
With Suspension Loop.

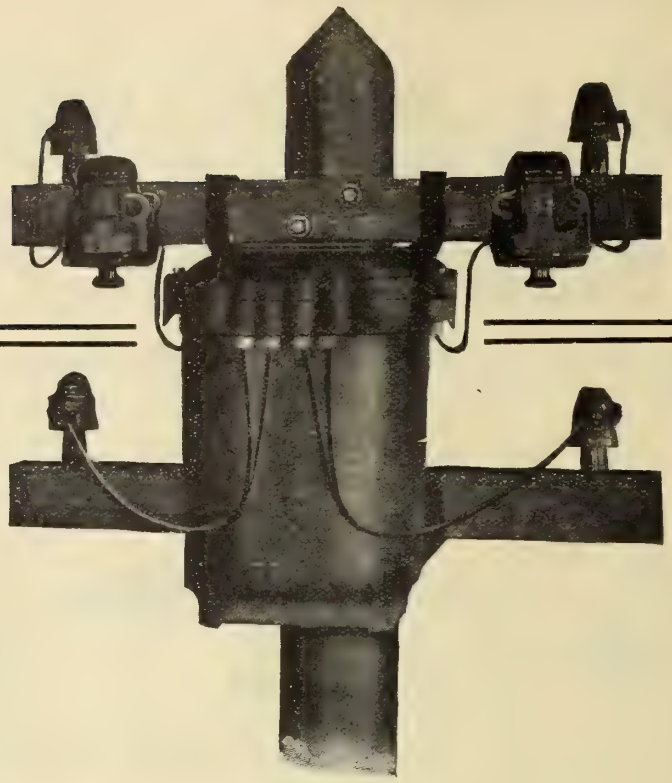
Complete line of "1914" Fixtures described in Bulletin F now ready for distribution.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



Moloney

On the Line



For 16 years we have manufactured high efficiency transformers—we make nothing else. Moloney transformers whether on the line or in the station will transform current with the lowest possible core loss because they are designed and built by experienced electrical engineers.

A Moloney will give high commercial efficiency every day and all day long.

Buy or specify Moloney—it is the best.

Our catalogue should be in your office.



Canadian Moloney Electric Co.

WINDSOR, ONT. **Limited**

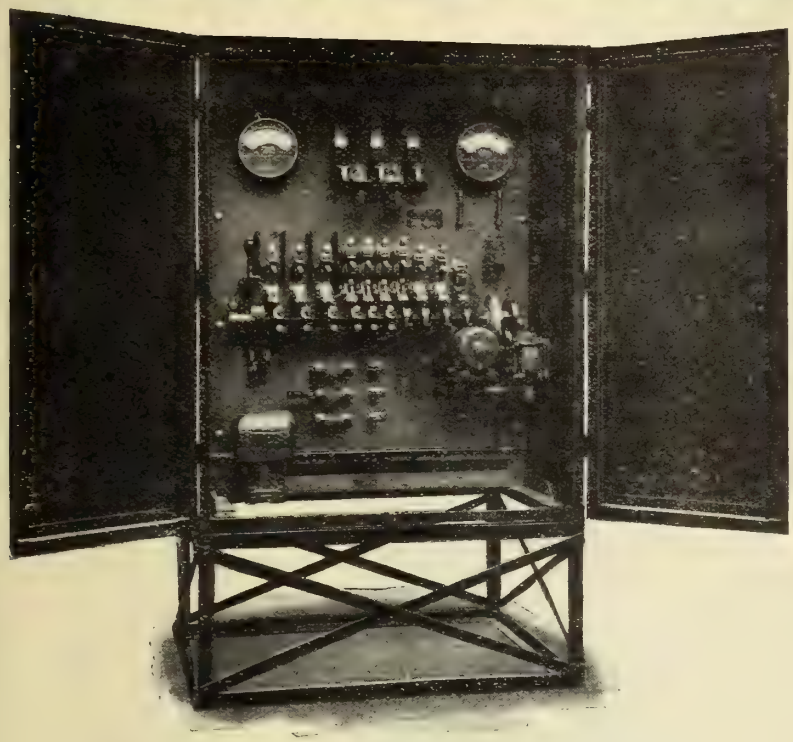
Factories at Windsor, Ont. and St. Louis, Mo., U. S. A.

825 Vancouver Block, Vancouver B. C., Canada
Winnipeg, Man., Canada

901 New Electric Railway Chambers,
501 C. P. R. Building, Toronto, Ont., Canada

Complete stocks carried at Windsor, Winnipeg and Vancouver

CUTLER-HAMMER



New Type Combined Hand and Automatic Starter for 100 h.p. 440 volt Three Phase Motor.

Works by Hand or Automatically Without Any Changes

The new Cutler-Hammer Fire Pump Starter can be operated by hand or automatically without the necessity for any changes, throw-overs, etc. Just as it stands it can be operated either way.

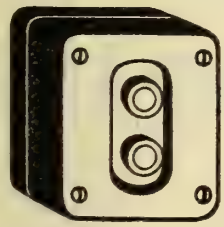
The choice of control apparatus for fire pump service is a serious matter. Being called upon to operate at infrequent intervals is the reason for choosing apparatus that can be relied upon. Cutler-Hammer starters have been approved by the most exacting Underwriters and Municipal authorities and have proven reliable in long years of service—"under fire." The

New Combined Hand and Automatic FIRE PUMP STARTER

provides for every emergency. Whether the attendant is present or not, this starter puts the pump in operation as soon as a sprinkler head opens, a hydrant is tapped or a leak occurs in the sprinkler system.

The hand and automatic operations are entirely independent, although the same cam-driven switches are used to accelerate the motor. To start the pump manually, a hand lever at left end of shaft is moved from the up position (as shown in the illustration) down through 180 degrees. This is often convenient for starting the pump for test purposes.

Bulletins on manual or combination fire pump starters sent on request.



PUSH BUTTON CONTROL

For fifteen years we have made push-button controllers for every class of service. Tell us what you want to accomplish and we will furnish the answer.

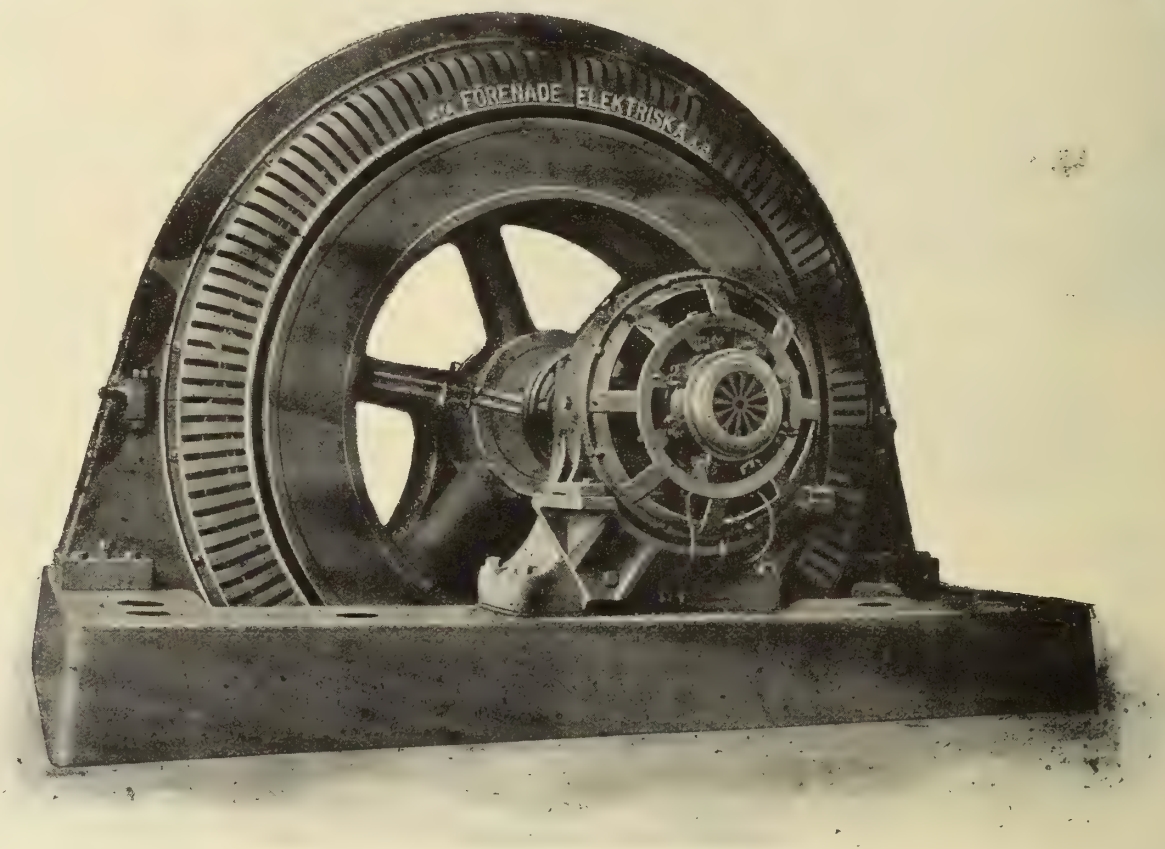
THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK: Hudson Terminal 50 Church Street CHICAGO. Peoples Gas Bldg. PITTSBURG: Farmers' Bank Building
BOSTON: Columbian Life Bldg. PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Building
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St., SAN FRANCISCO, 229 Sherlock Building, PORTLAND, ORE.
and W. B. Palmer, 416 East 3rd St., LOS ANGELES.

Swedish Electrical Machinery

Noted for

Efficiency and Workmanship



1800 K. V. A., 2200 Volt, 60 cycle, 3 phase 257 R. P. M. fly wheel type generator for direct connection to water wheel.

We solicit your specifications for Electrical Equipment

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LIMITED

Canadian Dealers for

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Head Office:
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MOONSTONE GLASS

for all kinds of illumination where artistic efficiency is desired.



No. 9070



No. 9050

In Moonstone Glass the absorption of light is less than in any other semi-translucent glass on the market.

Our Moonstone Bulletin No. 1, recently issued, illustrates many decorative and artistic designs in illuminating glassware.

No. 9070—Grecian Lantern made in five different sizes.

No. 9050 — Canteloupe Ball Globes made in five different sizes.

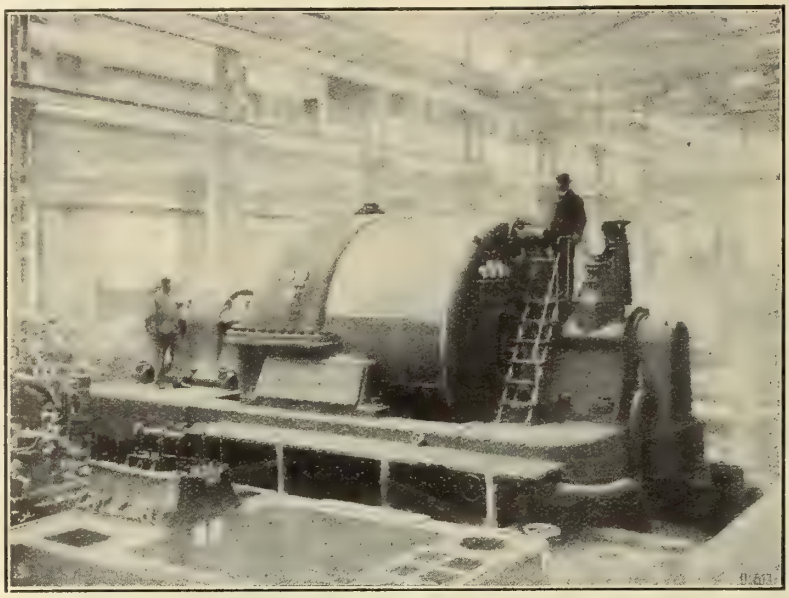
Have you received a copy of Moonstone Bulletin No. 1? If you have not write for yours today.

The Jefferson Glass Company Limited

MADE IN CANADA

TORONTO CANADA

ESCHER WYSS



28,000 H. P. Zoelly Steam Turbine

Zoelly Steam Turbines

up to

15,000 K. W.

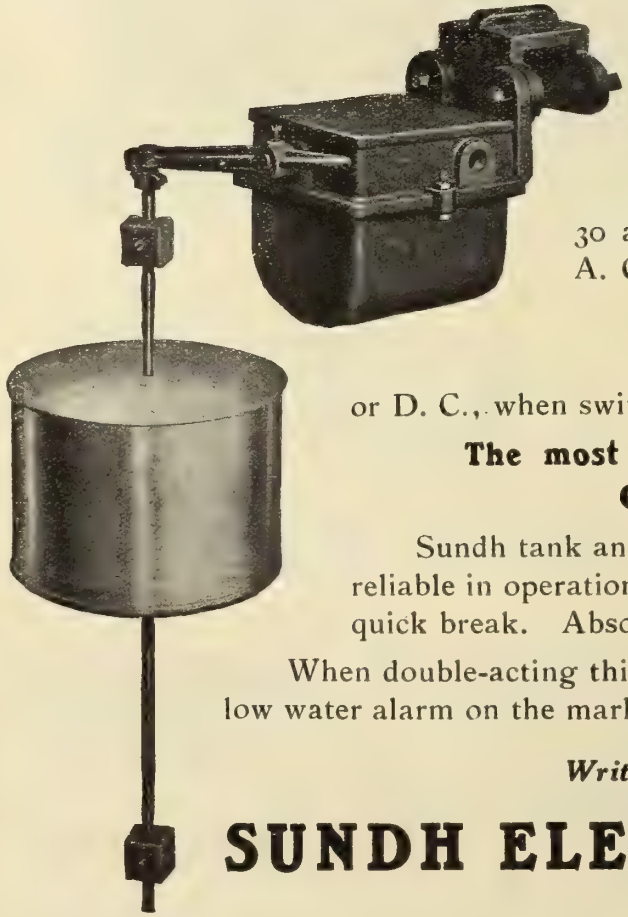
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Sundh Tank and Sump Switches

RATING

30 amperes normal capacity at 115 and 230 Volt A. C. or D. C.

30 amperes normal capacity at 440 Volts A. C.

30 amperes normal capacity at 550 Volts A. C. or D. C., when switch is wired for a single pole double break

The most serviceable Switches produced for Controlling Water Levels.

Sundh tank and sump switches are rugged in construction and reliable in operation. Have a snap action which unfailingly gives quick break. Absolutely weatherproof

When double-acting this type of switch forms the most reliable high or low water alarm on the market

Write for catalog and prices.

SUNDH ELECTRIC CO., NEW YORK, U.S.A.



National Railroad Trolley Guard

Made of wire mesh having one-inch openings which allows free passage of locomotive exhausts, minimizes effect of wind and prevents collection of ice and snow to any extent.

Light in weight, easily installed and requires little maintenance.

Over 75,000 Feet in service

OHIO BRASS CO., Mansfield, Ohio, U. S. A.

A SILCOR TUMBLE

Beats The Balls Buffer, Sand Blast

And all other devices for polishing

THE HIGHEST AND CHEAPEST LUSTRE AND IN EVERY TINY CORNER

TENDER WITH THE MOST DELICATE BUT CUTS THE HARDEST STEEL BRASS, NICKEL, CAST IRON, GERMAN SILVER, STEEL—ANY METAL

Small Plants—Five dollars' worth of "SILCOR" and an improvised barrel will save most all that hand labor.
Large Plants—Dispense with hand labor and roll both tiny and huge pieces in "SILCOR."
Holding a piece to a buffer is as illogical as turning the buffer by hand. Let the Power roll it in "SILCOR." "SILCOR" will find every spot.
It costs so little to polish by tumbling with "SILCOR" that no piece ought to leave your plant unpolished.
Send 10c and parcel postage for sample pound and shake some of your pieces in a tin can. Then send for a barrel load.

Corundum Products Company

Spokane, Washington, U. S. A.

"EUREKA" ELECTRIC CLEANER



Thoroughly reliable and absolutely guaranteed. Sold at a moderate price with a good profit to the dealer.

Write for particulars and agency.

Onward Manufacturing Co., Berlin, Ont.

ASK US about Efficient Lighting

for your streets, factory, warehouse or yard

A. H. WINTER JOYNER, Ltd.

76 Bay Street, Toronto

"Consult A Specialist"

CANADA WIRE & CABLE CO., LIMITED
CANADA
TORONTO CANADA

New Code
Rubber Covered
WIRES AND CABLES

Manufactured in accordance with the specifications of the National Board of Fire Underwriters.

SPECIFY CANADA WIRE & CABLE CO., LIMITED CANADA TORONTO CANADA **BRAND**

All our new code wire is inspected by the Underwriters Laboratories, Inc., and have their inspection tags attached.

Price list and discounts on application to head office or nearest agent.

Large stock, from which we can make prompt shipments, carried at Toronto, Montreal, Winnipeg and Vancouver.

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1160-1170 Dundas Street
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Sales Agents:

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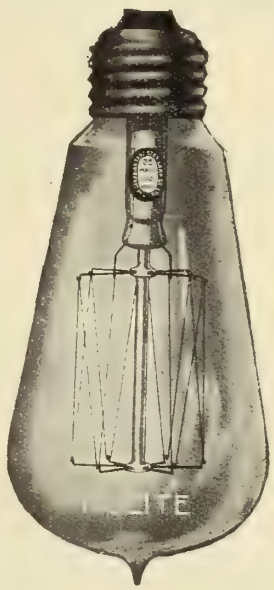
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NULITE

HERE IT IS



Genuine Drawn Wire

Continuous Filament

TUNGSTEN LAMP

We Reduced the Price but The Quality Remains the Same

The price of "Nulite" Tungsten lamps has been periodically reduced in the past, but the "unexcelled" quality of material and workmanship is gradually mounting higher and higher.

We have an excellent proposition to offer all dealers, which includes a series of advertising circulars and ideas.

Now is the time to lay in your supply.

THE CANADIAN TUNGSTEN LAMP CO., LTD.

HAMILTON, ONT.

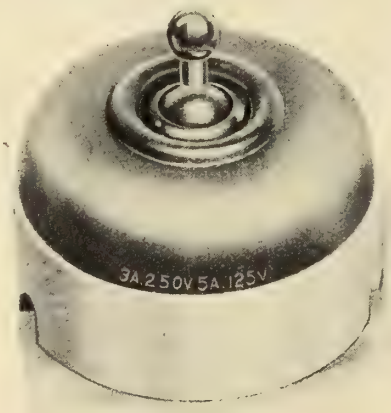
Branch Warehouses at: **Montreal**—246 Craig St. W. **Winnipeg**—56 Albert St. **Vancouver**—365 Water St.

AGENCIES: T. McAvity & Son, St. John, N.B.; Farquhar Bros. Ltd, Halifax, N.S.; Mechanics Supply Co., Ltd., Quebec, Que.; Dominion Illuminating Co., Ltd., Toronto, Ont.

The writer of this ad. uses the

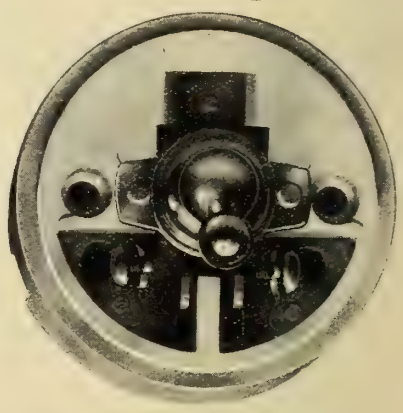
Duncan Newcode Tumbler Switch

in every room in his house,
from cellar to garret



Switch closed

and they are certainly a Fine Switch at any price



Switch open

THEY have been especially designed to meet every requirement of the Canadian Fire Underwriters and each switch bears their approval.

Each one of your customers will be as enthusiastic as the writer if you sell 'em Duncan switches.

Order through your Jobber

The Duncan Electrical Co.

MONTREAL Limited

Makers of Electrical Supplies of Duncan Quality

P.S. The writer is in no way connected with The Duncan Company and bought his switches in the open market.

This Big, Husky Bracket Used to be a Specialty: It's a Tonnage Proposition Now

because dozens and scores of Central Stations are finding out that it is a real money saver in service as compared with the common or garden variety that was born with the telegraph and never grew up.

The wide base of this bracket is formed by a broad steel strap, securely riveted to both the pin and the backbone.

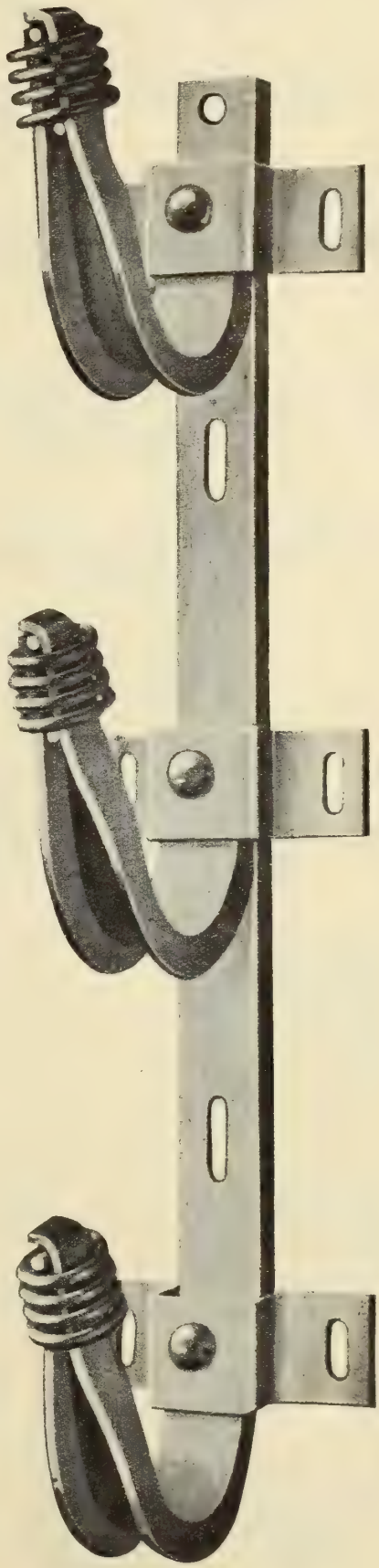
The pins and the backbone are made of **channel** section, **hot-rolled** open hearth steel, of extremely liberal dimensions. Channel steel construction originated in the Peirce Line.

Slots in the base straps, permit the use of additional bolts or spikes to anchor the bracket, the straps acting as levers and making it impossible for the bracket to roll over under severe strains.

The whole bracket—base straps, backbone, pins and rivets—is heavily galvanized by the hot dip process, which defers corrosion indefinitely.

Peirce specialties and Hubbard line hardware are carried by Canadian Electrical jobbers.

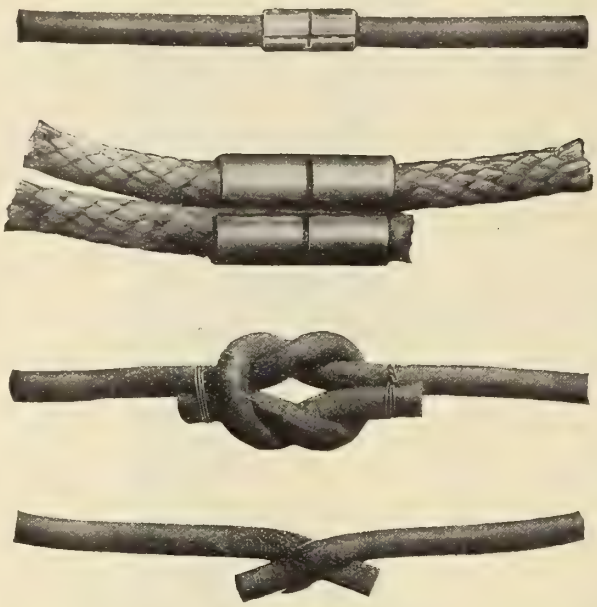
The Hardware MAKES the Line, Hubbard Makes THE Hardware



Hubbard and Company,

Pittsburgh, U.S.A.

Which Way Is Better and Cheaper?



You can get a whole lot of real satisfaction and you can save a lot of money by using these little devices—

Keystone Cord Connectors

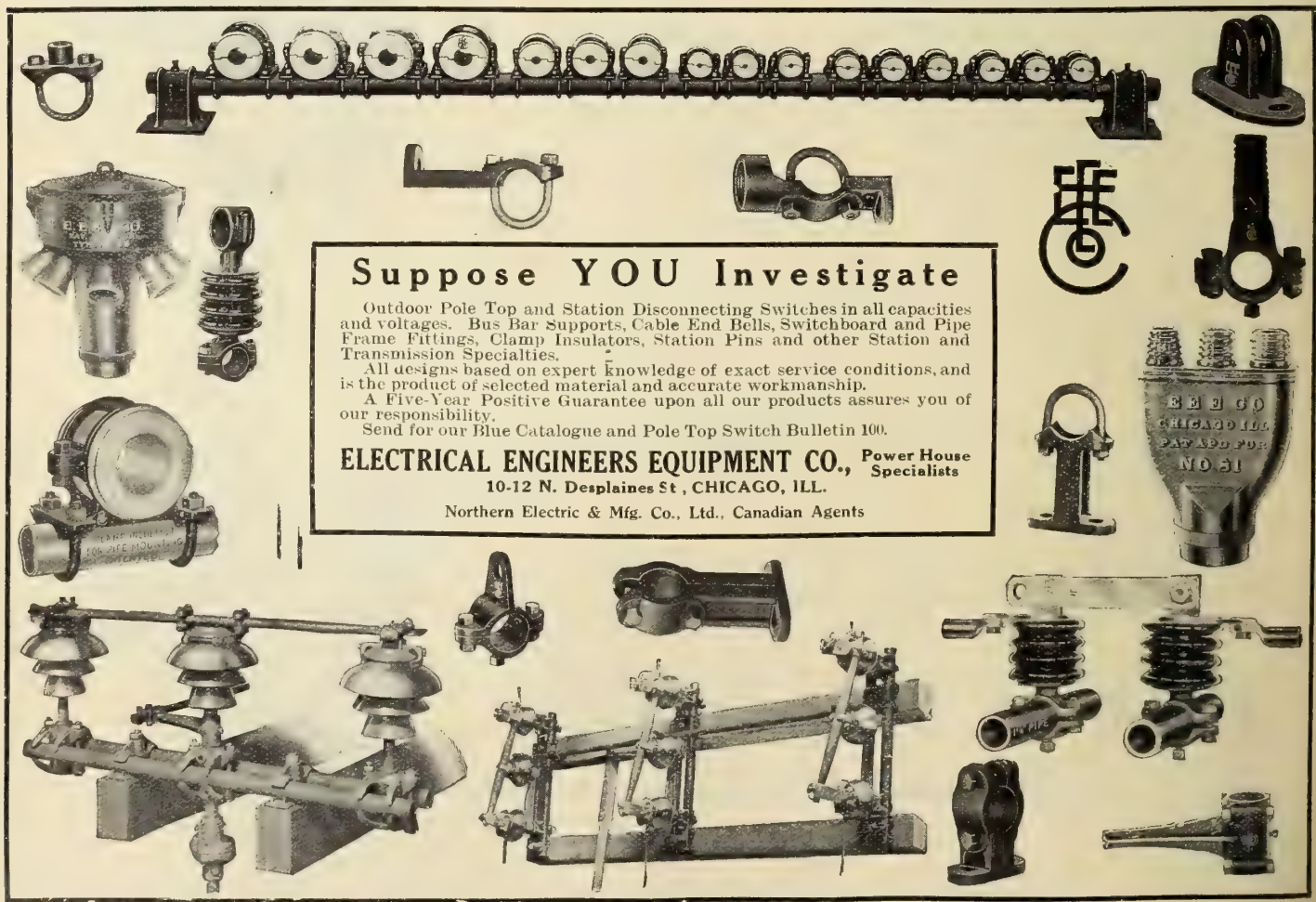
They are used for connecting together all kinds of cord, either cotton or leather, and are particularly adapted for connecting together either broken or new signal, bell or register cord. The finished joint is smooth and will travel through pulleys and guides as readily as the continuous cord.

Note that the Keystone Cord Connector is split in the middle, so making it easy to apply; and that the ribs on the inside of their soft steel shell have square edges that bite into the cord. Special pliers are furnished for applying, and connectors are furnished in either single or double types.

If you want to see a real cord connector, ask us for samples.

JOHN MILLEN & SON, LIMITED
Canadian Distributors
TORONTO MONTREAL WINNIPEG VANCOUVER

ELECTRIC SERVICE SUPPLIES CO.
Manufacturers
PHILADELPHIA 17th and Cambria Sts. NEW YORK Hudson Terminal CHICAGO 417 So. Dearborn St.



Suppose YOU Investigate

Outdoor Pole Top and Station Disconnecting Switches in all capacities and voltages. Bus Bar Supports, Cable End Bells, Switchboard and Pipe Frame Fittings, Clamp Insulators, Station Pins and other Station and Transmission Specialties.

All designs based on expert knowledge of exact service conditions, and is the product of selected material and accurate workmanship.

A Five-Year Positive Guarantee upon all our products assures you of our responsibility.

Send for our Blue Catalogue and Pole Top Switch Bulletin 100.

ELECTRICAL ENGINEERS EQUIPMENT CO., Power House Specialists
10-12 N. Desplaines St, CHICAGO, ILL.
Northern Electric & Mfg. Co., Ltd., Canadian Agents

Electrical News
Generation, Transmission and Application of Electricity

Published Semi-Monthly By

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HUGH C. MacLEAN, Winnipeg, President.
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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 **Toronto, November 1, 1913** **No. 21**

Trade Prospects for 1914

We are again approaching that season of the year when it is the general custom to take stock of the last twelve months' business and make plans for the next season. For this reason, as well as for the fact that the past year has been attended with very unusual conditions, a few remarks on the trade outlook for the coming year will be opportune.

Whether or not the year 1914 will be an active period for us industrially, depends, in the main, on two factors: (1) the natural demand for manufactured products, and (2) our financial ability to purchase these products. Without question there is only one answer to the first. Canada's capacity for almost unlimited development is established beyond the shadow of a doubt, so that our manufacturers may be assured of an ever-increasing demand for practically every class of manufactured articles. It remains then to discuss only the ability of Canadians as individuals, municipalities or private companies to provide the purchase price.

During the past summer, tight money has been a very real obstacle in the way of certain lines of activity. This condition was brought about partly by the unusual requirements of the European continent; also to a considerable extent by the amount of money that had become tied up in realty investments from one end of the Dominion to the other; but these conditions were intensified by the conservative, ultra-conservative we believe, attitude of our banks. Arguing that the signs foreshadowed a repetition of the crisis of 1907 and similar previous periods, and believing that prompt action would save the situation, they have followed the policy, apparently quite consistently, of lending no money which, as they thought, could by any possible chance be used to encourage the general extravagance to which Canadians were rapidly becoming habituated—the result largely of a number of years of unusual prosperity and plentiful money which had turned the heads of a large percentage of our citizens. This action of the banks has caused a great deal of discomfort to even their most deserving customers, and while it is generally conceded that caution, in reason, was the wisest course that could have been followed, it appears to us that the banks, by taking the extreme course, have unnecessarily curtailed the circulation of money and have done much towards producing the very condition—a trade reaction—they sought to prevent. Just how far their course was justified is difficult to determine, and it has undoubtedly placed the banks in a sound position so that at no time have they had to refuse assistance for developments which, in their own judgment, they have considered necessary. As a result the larger industrial life of the country has not suffered seriously, nor is there any sign of it in the future, for want of sufficient capital. Certain industries report the biggest year's business in their history.

How Scarce is Money?

As already indicated, the extent of the demands to be made on our factories during the next twelve months will depend on the amount of money in the hands of (1) the individuals, (2) municipalities, and (3) private corporations. Our recent bountiful harvest has been an all-important circumstance which will mean that the general public is pretty well supplied with ready money. The farmer only knows through the newspapers that money is scarce. As a result, the small retailer of general supplies such as hardware, boots and shoes, etc., except in the larger centres, will probably not experience any diminution in trade; this means continued prosperity for the wholesale dealer and manufacturer. In the building industry, is it not a fact that practically every city and town in Canada is under-supplied with both public and residence buildings; and the population still continues to increase at a rapid rate. While building permits issued during the last month or two indicate a slackening in this line of trade, this, we think, is explained in large measure by the very general feeling that both workmen and supplies will be obtainable at lower rates; also, due to tight money, a certain amount of sacrifices have been thrown on the market. We see no sign of a diminished demand, however, and this slight reaction will just mean an increased activity in building trades of all kinds as soon as the money situation has readjusted itself. With an already inadequate supply of buildings, an ever-increasing population, and a fair distribution of money among the middle classes, the demand for all kinds of building materials seems assured.

With the larger municipalities and private corporations the outlook may not be so entirely optimistic. These have found it necessary, often, to go outside of Canada for their supply of money, which has not been so readily forthcoming during the last few months, on account of similar demands from other sources. Canada's natural resources, however, constitute a splendid security which stands behind all her industrial undertakings and we are confident that, even in a world competition, she can obtain the necessary supply of capital; perhaps, just at this time, at a little higher rate, but not so high that the resultant developments will not amply justify the increased cost.

Rural Prosperity

And after all has been said on both sides Canada's immediate and ultimate prosperity is inseparably tied up with the prosperity of her great rural population, which at the present moment is possibly not equalled in any other country in the world. Our crops, just harvested, will put into the pockets of the farmers during the next few months in the neighborhood of $300,000,000. This will soon find its way through the usual channels to the manufacturers. To this sum might be added dividends from investments which are

being distributed to the general public at the annual rate of something over $150,000,000. This will also indirectly reach the manufacturer. The extent to which the natural frugality of the average citizen will assist in the readjustment of conditions is, of course, difficult to determine in dollars and cents, but there is no doubt that at a time like the present a general policy of curtailment is being followed by most of us and these accumulations will be ready for circulation as soon as the general public judges the opportune moment has arrived.

Summing up the situation, while we anticipate that difficulties will continue to be encountered for some time in obtaining large sums of money abroad, this condition, we believe, will be more than offset by favorable local factors, of which we may mention—(1) the unsatisfied demand for every kind of manufactured product; (2) unexampled prosperity of our great rural population; (3) good security and high returns of Canadian investments which means ability to borrow abroad; (4) present low conditions of stock supply; it is generally conceded that the retailer is running very low following the general policy of caution.

Guarding Electrical Contractors' Interests

By a recent act of the Ontario Provincial Legislative Assembly every municipality of sufficient size is now required to organize a municipal electrical inspection bureau (and others of smaller size are grouped in a district) and appoint an inspector, so that all rules and regulations with regard to the correct wiring as approved by the Hydro-electric Power Commission, may be carried out. Already a number of municipalities have complied with the requirement and others are only waiting the location of a suitable man. Some of the municipalities, however, have been dilatory in complying with the requirements. More or less pressure has been brought to bear by the Commission but the government as yet has taken no steps to see that its recent enactment is carried out to the letter. The question has been raised, and it is apparently worthy of consideration, whether the municipality, in case of loss to life or property, might not be held liable if it could be shown that a proper enforcement of the law would have prevented the calamity.

In the city of Toronto no inspection bureau has yet been created by the municipality. The private company has its own inspector, as has also the Toronto Hydro-electric System, and the Board of Control has contended that where there was no demand for such an appointment they were under no obligation to make it. However, the question is now being taken up by the Electrical Contractors' Association of Toronto, with the object of showing the necessity for such an appointment under existing conditions and a resolution was recently passed and submitted to Mayor Hocken favoring the establishment of a municipal electrical inspection bureau that would see to it that electrical installations must be in a perfectly safe condition before connections with the supply mains can be made. It is stated that the not infrequent experience of contractors is that connections are now being made by both systems operating in Toronto that should not be made—the result, to a very great extent, of the competitive conditions existing there.

The electrical contractors at a recent meeting further placed themselves on record as being in favor of the fee system being adopted, with the limitation that the charge for inspection for one building should not exceed $10. The argument in favor of the fee system is that this would make the department self-sustaining, which, it is claimed, would help to remove it from political influence. It was also the unanimously expressed opinion that all contractors should be licensed. This would make it possible to place the blame for poor work on the proper parties and so would make a man careful of his reputation, and would further make it possible in case any particular contractor continued to do unsatisfactory work to remove his name, if necessary, from the licensed list. In this connection it is claimed that much incompetent work is being done by so-called electrical contractors who have not the necessary knowledge and experience, and that quite often large installations of a perfectly satisfactory character are rendered unsafe through some little addition or extension by a novice.

Other suggestions made by the association were to the effect that no connections should be made to any installation without the approval of a proper inspector; that all electric lighting fixtures be inspected; and that inspection be made within one full working day of the date on which the inspection is filed.

In the meantime, of course, the inspection of the Canadian Fire Underwriters' Association covers the field as far as its authority extends but this association has no means of enforcing its regulations on unwilling customers who are always able to place their insurance risks with some company not included in the association. Such a risk, too, is often the very one that needs the most careful inspection.

In connection with the licensing of electrical contractors it may be noted that an ordinance in Chicago, effective October 1, requires all electrical contractors to be registered by the city department of electrical inspection. The initial fee is $25 and the annual renewal charge $10. Any electrician, who supervises electrical construction, must have had four years' experience at the trade. This applies to electrical contractors as well as foremen. This means a competent man in charge of every job, as it ought to be.

140,000 Volt Transmission

A bulletin has just been issued describing the properties and power developments of the Nevada-California Power Company and Southern Sierras Power Company with special reference to the most economical and efficient use of water as illustrated by this installation. The bulletin is distributed by Mr. Geo. J. Henry, of San Francisco, who supplied the hydraulic apparatus.

This development is unique in that the ultimate plans are calculated to use the water of a small mountain stream in the State of Nevada seven times over. Bishop creek has a length of about 14 miles down the mountain side, with a fall of 5,500 ft. in that distance or nearly 400 ft. to the mile. The depth of the canyon walls is in most places about 1,000 ft.

The first power house was installed in 1905 and is now known as plant number 4. This consists of 6,000 kw. capacity. In 1907 plant number 5 of smaller capacity was installed; in 1908 number 2 was built. In March of the present year number 6 was placed in operation followed one month latter by number 3. The plant to be known as number one and a smaller one to be known as plant A yet remain to be installed.

A feature of great importance in connection with these developments is a 239 mile transmission line which carries power at 140,000 volts. The efficiency of the transmission and the load factor are uncommonly high there being only a loss of 18 per cent. at 80 per cent. load factor. The cost of operation is also very low being 18 per cent. of the gross operation of the system. Steel aluminium conductors are used throughout.

The water flow varies from a maximum of 500 cubic feet per second to a minimum of 30 second feet and a system of three reservoirs is being built, two of which are already in operation.

The water is carried throughout in either gravity flow or pressure pipes, there being no open canal, ditch or tunnel. This was done for the three-fold purpose of conserving water,

getting the benefit of regulation from the intake reservoir and preventing snow and ice getting into the conduit lines.

The turbines in number 2 plant operate under a 938 feet head, and in number 3 plant under an 814 feet head.

Cannot Force Terms

Following a recent decision by Commissioner Robson that the city of Winnipeg be allowed to supply power to the city of St. Boniface, and following the refusal of the council of St. Boniface to grant permission to the city of Winnipeg to use the public roads and streets of St. Boniface for the proposed extensions of its electrical system, the city of Winnipeg again appealed to the Public Utilities Commission of Manitoba.

The city of St. Boniface submitted:

1. That the city of Winnipeg had no power to carry on a light and power business beyond the limits of that city.

2. That the dominion of the city of St. Boniface over the streets in that municipality should not be interfered with in the manner proposed.

3. That in any event there is satisfactory provision at present for the needs of that community, that is to say, by the service of the Winnipeg Electric Railway Company, who established a system there under terms imposed by St. Boniface.

As Commissioner Robson had already decided that the city of Winnipeg was empowered to carry on a light and power business beyond the limits of that city, the first objection did not stand. The Commissioner pointed out, however, that while Winnipeg may have authority to do business with another municipality it was entirely another question how they should procure permission to use the property of that other municipality. As in this case St. Boniface was not willing to grant the city of Winnipeg the right to install poles and string wires in their city and inasmuch as there is no present demand or necessity for this extra service the matter must stand in accordance with the St. Boniface application.

Abitibi Pulp and Paper Company

The turbines and generator equipment for the Abitibi Pulp and Paper Company's plant at Iroquois Falls are being supplied respectively by the Holyoke Machine Company and by the Canadian Westinghouse Company. Two generators will be installed initially. Each of these has a capacity of 1,250 kv.a. (1,000 kw., 80 per cent. p.f.), 2-bearing, waterwheel type, 3-phase, 60 cycles, 600 volts, 240 r.p.m., complete with bearings, double bed-plate, shaft extensions and field rheostats to be arranged for coupling to water wheels. Two exciters 52 kw. capacity each, 125 volts, 240 r.p.m. will be installed direct connected to the generator. The Canadian Westinghouse Company will also supply a seven panel natural black slate switchboard for controlling both generators and exciters. An order has been placed with the Canadian General Electric Company for motors aggregating something over 2,000 horse power.

Western Canada Power Extensions

The Western Canada Power Company, Limited, have been proceeding with the raising of their dams on the Stave River an extra ten feet, so as to provide storage for two additional generating units. The sluice dam and intake dam have both been raised this amount and the Blind Slough dam is now being raised to the same level. Contracts were awarded some months ago to the Escher Wyss & Company, of Zurich, for the construction of two additional turbines of the capacity of 10,000 kilowatts each, which are to be delivered in April and June next respectively. The Canadian General Electric Company is constructing the generators of the same capacity. The power house building is being extended to a sufficient capacity to receive these two new units. The contract with the British Columbia Electric Railway Company came into operation on September 1st, and in addition the Puget Sound Light and Power Company is receiving power to the amount of approximately $10,000 a month. During the months of August and September there was some slackening in the demand of industrial power, owing to the financial stringency in the West, but the factories are now increasing their demand.

Prince Rupert Hydro-Electric

The powers controlled by the Prince Rupert Hydro-electric Company consist of Khtada Falls, situated 38 miles from the city of Prince Rupert, which will develop 30,636 h.p.; a power known as McKnight's, 32 miles distant, capable of developing 28,150 h.p.; and the Falls River, 38 miles distant, with a possible development of 25,000 h.p. The two former powers have a drainage of sixty square miles, and the Falls River has a drainage of 100 square miles. The company has announced its intention of developing the Falls River power first, and the others as required. It is understood that the cost of the proposed Falls River plant has been estimated at approximately $2,500,000. In the meantime, while the Falls River development is under way the company have constructed a plant at Port Edward, about five miles from Prince Rupert, and Dick, Kerr & Company, of England, have built for the company two Diesel engines of a capacity of 1,000 kw., which are now about to be shipped. These engines will be used to supply the local market temporarily, and will subsequently be used as an auxiliary plant, when the hydro-electric plant is completed.

Central Station Exhibit

During a recent exhibition in Ottawa the booth of the Ottawa Electric Company was the centre of much interested observation. As will be seen from the accompanying photo-



Ottawa Electric Co's Exhibit

graph of this exhibit, a very wide range of electrical equipment was displayed, covering the latest and most efficient types of ornamental lighting units as well as various household appliances. The Ottawa Electric Company has always been noted for their forward methods in advertising and popularising the uses of electricity and the picture shows that during the recent exhibition they were fully maintaining this reputation.

Regulations re Line Conductors

Revised regulations have recently been issued on the German requirement regarding copper and aluminium overhead conductors. These regulations come into force on January 1st, 1914, and are printed in part herewith as being of interest for comparative purposes with the regulations existing in Canada.

These regulations apply to all overhead conductors with the exception of railway feeders and short house-lighting feeders with supports less than 20 metres apart. The smallest permissible cross section for heavy metals (copper) is fixed at 10 sq. mm., and for light metals (aluminium) at 25 sq. mm. The following standard sizes are to be adhered to:—

Sect. area, sq. mm.	No. of wires in strand	Diam. of each wire in mm.	Diam of strand in mm.
10	1 (solid)	3.5	——
16	1 "	4.5	....
16	7 (strand)	1.7	5.2
25	7 "	2.1	6.5
35	7 "	2.5	7.7
50	14 "	2.1	9.2
70	19 "	2.1	10.9
95	19 "	2.5	12.7
120	19 "	2.8	14.2
150	30 "	2.5	15.9
185	37 "	2.5	15.9
240	37 "	2.8	20.1
310	61 "	2.5	22.9

The pitch or lay of the strand shall be from 12 to 15 times the diameter of the strand.

Standard materials are copper and aluminium having the following characteristics:—

Diameter of wire in mm.			Loads in kgs. which wire shall sustain 1 mi. without break.		Resistance in ohms per km. max. at 20°C	
Nom.	Min.	Max.	Copper	Aluminium	Cu.	Al.
1.7	1.70	1.75	90	...	8.0	....
2.1	2.1	2.2	140	60	5.2	9.0
2.5	2.5	2.6	200	85	3.7	6.4
2.8	2.8	2.9	250	105	3.0	5.0
3.5	3.5	3.6	380	...	1.85	....
4.5	4.5	4.6	600	...	1.15	....

The wires shall in addition show a cup-shaped formation at the point of break.

The erection tables of spans and sags are based on the assumption that under the most adverse conditions the stress on the line shall not exceed the following values:—

For solid copper 12 kgs. per sq. mm. (17,000 lbs. per sq. in.)

For stranded copper 16 kgs. per sq. mm. (22,700 lbs. per sq. in.)

For stranded aluminium 7 kgs. per sq. mm. (10,000 lbs. per sq. in.)

These values are also to be adhered to when the line is erected with spans other than those for which the tables have been calculated.

Material other than that specified above (including copper and aluminium with special properties) may be employed, provided that under the most adverse conditions the maximum stress does not exceed one-third the elastic limit for solid wires, and one-half the elastic limit for stranded conductors. The elastic limit is defined as the stress which will produce a permanent elongation of .2 per cent. after application of the load for a period of one minute.

The working stress is calculated at —20 deg. C. with no additional load, and at —5 deg. C. with additional load due to ice and snow, wind, etc., given by the formula (190 + 50 × d) grams per metre of conductor, where d is the diameter in mm. of the strand. For uncovered copper and aluminium conductors the sags and tensions should be in accordance with the tables. Where the supports are not exactly on a level, the span is taken as the horizontal distance between supports and the sag as the vertical distance measured below a straight line joining the two points of support.

All joints in the run of the cable must have a tensile strength equal to at least 85 per cent. of that of the conductor in which the joint occurs. All welded or soldered joints must be relieved of all tension.

Support of Conductors

All binding wire must be of the same material as the conductor and in the case of aluminium of the same hardness. Binders of aluminium must not be liable to be subjected to friction, vibration or cutting action. At curves the conductor shall be so arranged on the insulator that it presses on the latter instead of tending to pull away from it.

The following values have been taken in calculating out the tables of sags and spans:—

Specific gravity: copper, 8.9; aluminium, 2.75.

Coefficient of expansion: copper, 0.000017; aluminium, 0.000023.

Modulus of elasticity: copper, 13,000,000; aluminium, 7,150,000.

It was also assumed that the modulus of elasticity of stranded conductors was the same as for solid wires, which is probably correct for lines under tension.

Cedars Rapids Development Work

A progress report has just been issued by the Cedars Rapids Manufacturing and Power Company describing the work accomplished to date in connection with their hydro-electric development at Cedars Rapids. This work is in charge of the engineers of the Shawinigan Water & Power Company and of the Montreal Light, Heat & Power Company, Mr. Julian C. Smith chief engineer of the former having particular charge of the hydraulic end and Mr. R. M. Wilson, superintendent of the Montreal Light, Heat & Power Company, having the electrical work under his particular supervision. The present report deals of course with the hydraulic end principally and has been issued subject to Mr. Smith's supervision. The following extracts from the report are of special interest an indicating the fundamental features of what will probably eventually be the largest purely Canadian hydro-electric plant installed to date.

About fifty miles west of Montreal the St. Lawrence River widens out into Lake St. Francis. Above Lake St. Francis is a long series of rapids, known principally by the name of the largest one, The Long Sault. Below Lake St. Francis, and nearer Montreal, lies another expansion of the river named Lake St. Louis, and between these two lakes the St. Lawrence River falls a distance of about 80 feet, made up principally of three rapids, viz.: Coteau, The Cedars and The Cascade. Thirty-two feet of this total fall is in the Cedars Rapids, thirty miles to the west of Montreal.

The Canadian Government has built canals on both sides of the St. Lawrence River to navigate these three rapids, that on the South being called the Beauharnois Canal, and that on the North the Soulanges Canal. The Beauharnois Canal has been practically abandoned for navigation purposes. All the traffic from the Great Lakes to the sea passes through the Soulanges.

The St. Lawrence River is one of the greatest rivers of the world; it drains a territory of about 300,000 square miles of which a very large percentage is lake area, and it is unique among all the rivers of the world in the steadiness of its flow. The ratio of the flow in the lowest and in the highest years being 3 to 1. Comparing this with the other large rivers of this continent, such as the Susquehanna which has a range of 75/1, and the Mississippi which has a range of about

25/1, it is evident that the St. Lawrence is remarkably uniform in its flow. This fact is of inestimable value to any water-power development, and it is this fact that has placed the development at Niagara Falls in a class almost by itself as regards the question of water supply. Other rivers may be developed by the construction of storage reservoirs, and in a few cases, such as with the St. Maurice River, this can be done at a reasonable expense with remarkable results, but the largest natural reservoir in the world, the Great Lakes System, provides an equalization which is not only from year to year, but from one wet cycle, extending over a term of years, through the intervening dry cycle.

For many years the development of the rapids in the St. Lawrence River has been discussed, and plans have been made based on different types of development. In view of the treaty between Great Britain and the United States, which established the International Waterways Commission, any waterpower developments made on the St. Lawrence River, are subject to the approval of the Commission. No diversion of the water from the river are permitted without careful investigation, which insures that the levels for navigation purposes are not affected.

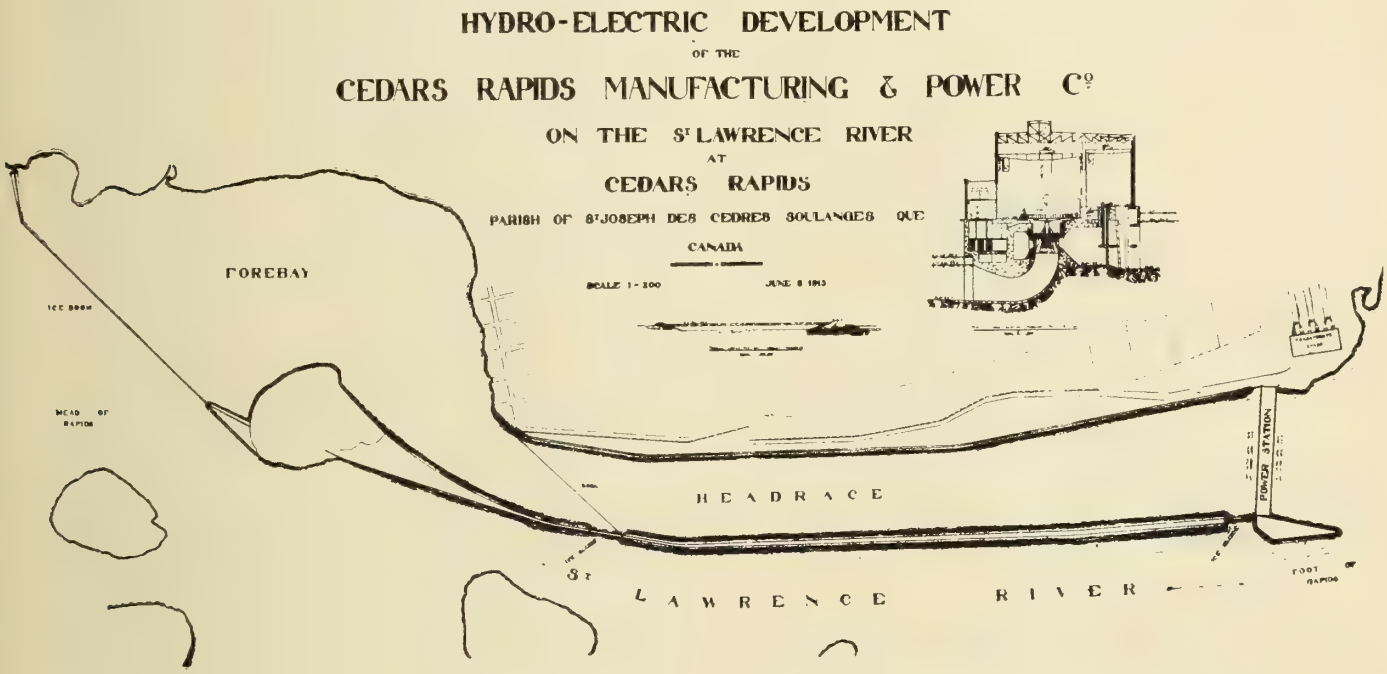
The plan herewith shows the general scheme of development. The rapids at Cedars extend over a distance of about two miles. In order to use this fall, it is necessary to concentrate this difference of level at one point. To do this a canal is being constructed along the north bank of the river. The outer wall of the canal is an artificial bank formed of excavated rock taken from the canal section and made watertight by clay filling on the inside.

This combination rock-fill earth bank is being built with ample factors of safety, and special precautions are being taken to prevent leakage or possible damage to this bank. As the maximum head against the bank will never be more than 30 ft., it is evident that this type of construction, which is common throughout the world in the case of large water reservoirs, is the most economical, on account of the fact that all the materials for the construction of the bank are available at the site of the work.

The canal when finished will have its outer or south bank practically a straight line two miles long, and parallel thereto a similar bank located on the natural flow of the river, and at a distance from the south bank of about 1,200 feet. The width of the canal on the water line will be about 1,000 feet, and the total length of the canal from the ice fender above the Isle-aux-Vaches to the power-house will be about 12,000 feet. Extending across the lower end of the canal and forming a dam, is the power-house structure itself. This structure is of concrete, and in the power-house is concentrated the total fall of 32 feet given by the difference of level between the top and bottom of the Cedars Rapids.

During the past few years great improvements have taken place in the design of low head water turbines, and single runner wheels can now be built having reasonable speeds, and developing large amounts of power. The policy of the Cedars Company has been not to endeavor to obtain the largest available units; the size of the unit was chosen more within a view to economic operation and confidence in its reliability, than with the endeavor to save a small amount by greatly increasing the size. Several plants have been constructed during the past two or three years, using this single runner type of wheel with success.

The cross-section of the power-house shows the water coming into a flume which encircles the water turbine. The water passing from the side of this flume into the openings of the waterwheel operates the waterwheel by pressure against by pressure against the curve vanes, and drives the



General plan of hydro-electric development of the Cedars Rapids Manufacturing & Power Company

generator located immediately above the wheel. The weight of the moving parts is carried by what is known as the thrust bearing, located in this plant on top of the generator. In most vertical developments in which large units are operating, considerable trouble has been experienced with the thrust bearings.

Coincident with the development of the single runner turbine, there has also been considerable development in the designs of these thrust bearings, and there are to-day several types available which are reliable, and which do not require constant operation of auxiliary apparatus to keep the bearings from burning out.

In order to make these bearings accessible for inspection and maintenance, the bearing is located on top of the generator where it can be easily reached with the crane.

By using this design, the total overall length of the generator and waterwheel was reduced to a minimum, and this has a very considerable advantage in reducing the distance between the guide bearings which hold the shaft vertically, reducing the number of bearings to two.

This waterwheel will develop a total output of 10,800

horse-power and the generator connected to it, and located immediately above, as shown on the accompanying plan (also see February 1, 1913, Electrical News), will transform this mechanical energy into electricity. These units will operate at a speed of 55 r.p.m. and judging by the performance of wheels of similar design, the waterwheels should have a very high efficiency.

Under its Charter and contract with the Dominion Government The Cedars Rapids Manufacturing & Power Company has a right to take 56,000 cubic feet per second into its canal, which, as indicated on the plan, is practically a part of the river. This amount of water is sufficient to develop continuously 160,000 electrical horse-power. The plans for the final development call for the installation of eighteen units of a normal capacity of 10,000 horse-power each, two of these units being regarded as spares.

In addition to the main units, there will be installed six water-driven exciter units, which will be described more fully in a later bulletin. These exciter units have a capacity of 1,500 horse-power and operate at a speed of 150 r.p.m. The general design of the waterwheels and generators is quite similar to that of the main units.

The efforts of the Engineers of the Cedars Company have been to make use of the experience which they have had in the design of other plants and the operation of the plants of the Montreal Light, Heat & Power Company and the Shawinigan Water & Power Company, and to make the design as simple and as reliable as possible. One of the bad features of most vertical waterpower developments is the fact that much of the auxiliary machinery, such as governor pumps, thrust bearing pumps, thrust bearings and other pieces of apparatus which although auxiliary in a sense yet are vital to the proper operation of the plant, are located in tunnels or rooms below the generator floor.

This arrangement while it tends to make the main generator floor free from such small pieces of apparatus and therefore improves in a sense the appearance of the floor, yet has a bad effect on the operation of the plant, not only because these pieces of apparatus are difficult to get at for purposes of repairs, but also because almost always these tunnels and rooms are lighted by artificial light only, and the operatives cannot be given the careful supervision from the skilled superintendent of the plant, which would be given could he see these machines without leaving the main floor of the building.

In the designing of the plant at Cedars Rapids, an effort has been made to put on the main floor all the equipment which is at all vital to the continuity of operation of the plant.

On account of the low head and the available space it was impracticable to use a horizontal type of development. The wheels at Cedars will have a diameter of about 18 feet, and the generators will be about 36 feet in diameter.

At the upper end of the canal, an ice fender is to be constructed for keeping out floating ice which comes down from Lake St. Francis, and which if permitted to come into the channel would cause trouble.

A type of ice fender is to be used which will consist of a series of submerged openings, so that the water entering the canal must be drawn in at five or six feet below the surface. As this ice fender has the same general direction as the main current of the river, the ice will strike this fender and will be carried along down the river by the main current without entering the canal.

This fender will not, however, take care of what is known as frazil ice, and special precautions are being taken to prevent interruption from this cause. Very large units are not susceptible to the same trouble from this kind of ice as smaller units, and a very large amount of this ice will pass through the wheels as the openings through these wheels will be about 7 feet high and 3 feet wide.

M. & S. C. Ry. Sub-Stations

By Mr. Julius G. Koppel

The installation described in this article of three 500 kw. Westinghouse rotary converters, with necessary equipment of transformers, lightning arresters, etc., was made during the past year for the Montreal and Southern Counties Railway Company at their new sub-station in St. Lambert, Que. A brief description is also given of the sub-station at Chambly Basin which contains a 400 kw. motor-generator.

Power is received at 25,000 volts from a three-phase, 60-cycle line (Montreal Light, Heat & Power Company) and transformed through three sets, each of three 180 kw. single-phase transformers, oil insulated, self-cooled, 60-cycle, delta connected, primary 25,000 volts and six-phase secondary 428 volts.

At the latter voltage power is delivered to three 500 kw., 6-phase, diametrically connected rotary converters shown in Fig. 1. These machines give 600 volts d.c. 833 amp. at 945 r.p.m. and are connected in parallel to the d.c. bus-bars.

The switchboards are of black marine slate mounted on iron frames. A total of 15 panels have been installed. The control panels for the incoming lines are located immediately in front of the high tension bus, which consist of two panels for each line equipped with signal lamp, overload trip coil and two inverse time limit relays. One voltmeter is used for both lines. The oil-switches are Condit type and hand operated. Current transformers operate the relays for each group of transformers. There are two panels for controlling the a.c. side of the rotary converters; these are equipped with ampere meter, two inverse time limit relays and trip coil for the oil switches. A signal lamp is connected between the low tension starting leads of the transformer to indicate if the transformers are operating. There are three generator panels with voltmeters, ammeters and reverse current relay to oper-

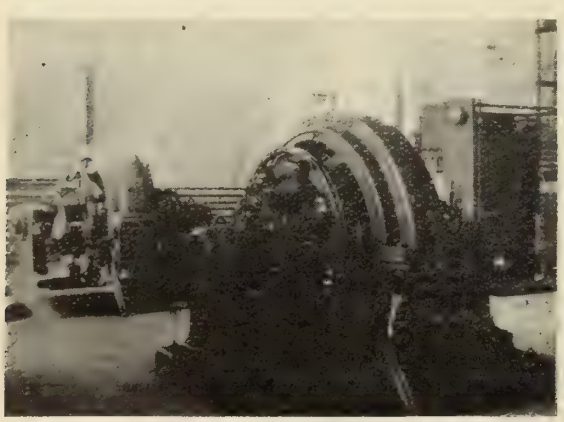


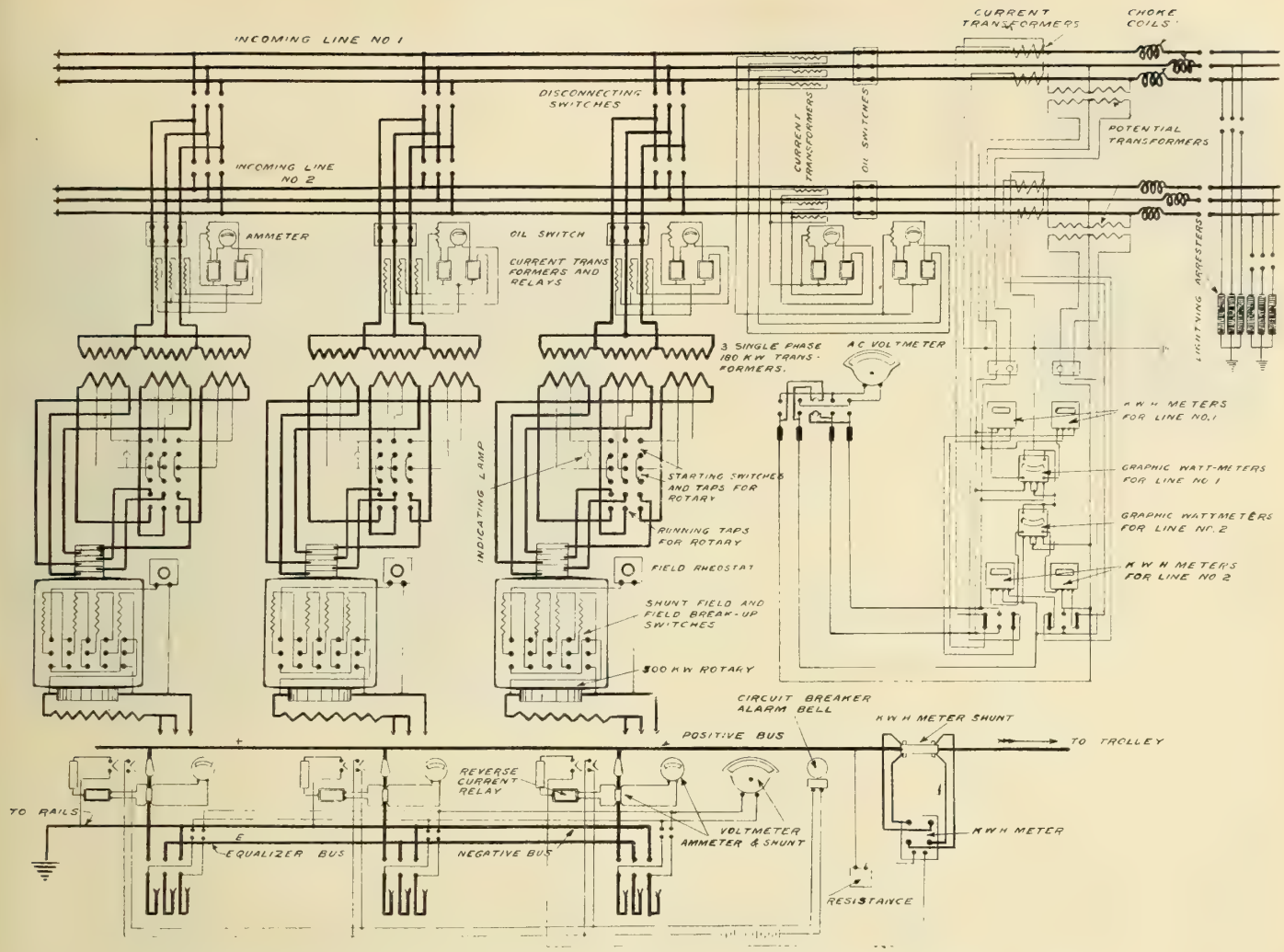
Fig. 1.—Rotary converters, St. Lambert



Fig. 2.—Motor generator, Chambly



Fig. 3.—Setting pins in insulators



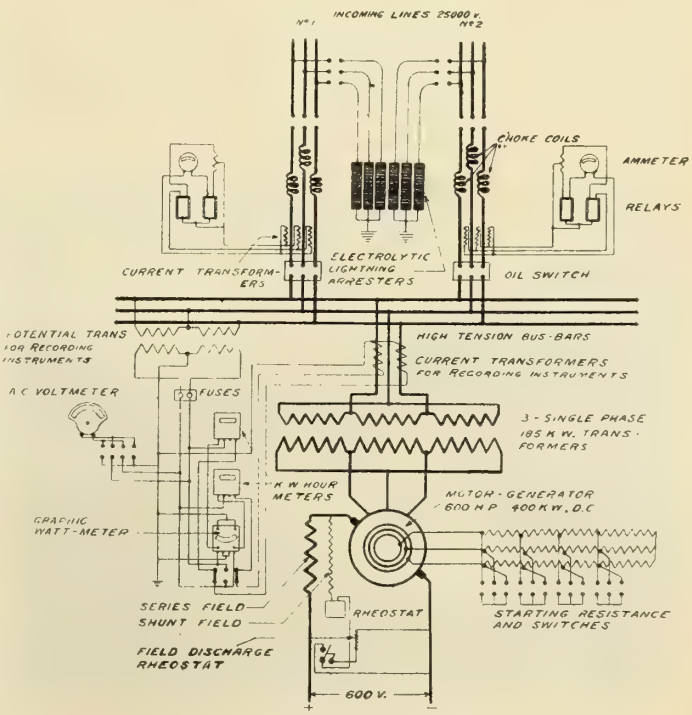
Wiring diagram, St. Lambert sub-station—Montreal & Southern Counties Railway Company

ate the circuit breakers. Four feeder panels carry ammeters, kw.h. meters and reaction coils for each feeder.

Lightning protection is afforded by two sets of air-cooled choke coils and three-phase type "A" electrolytic lightning arresters, Westinghouse manufacture. The arrester tanks are mounted in a separate room and so arranged that the operator may check the discharge on each set of lightning arresters. The arrangement consists of a 250 volt a.c. gong and an air-gap protector which is connected in the ground wire and the gong terminals are shunted across the air gap. In any charging or discharging of the lightning arresters a certain amount of current goes through the gong causing it to ring. The d.c. side is equipped with Garton Daniels, 600 volt, lightning arresters two for each feeder employed.

The sub-station at Chambly Basin, which is twelve miles distant, is designed to run in parallel with St. Lambert. Power is received at 25,000 volts, 3-phase, 60-cycle, and transformed through one set of three 185 kv.a. single-phase, transformers, oil-insulated, self-cooled, 60-cycle, delta-connected, primary 25,000 volts, and delta-connected secondary 2,300 volts. At the latter voltage power is delivered to a polyphase induction slip-ring motor, stationary primary and revolving secondary, rating 600 h.p. The d.c. end of the motor-generator is a commutating pole, 400 kw. machine, compound wound, 600 volts.

The switchboard panels are of black marine slate. A total of 6 panels—one generator panel, 2 feeder panels, 2 line controlling panels and one 600 h.p. motor panel with oil-switches four in number, and a cast iron grid resistance group star connected; controlling devices and meters the same as in St. Lambert sub-station; lightning arresters, electrolytic and Garton Daniels. Both sub-stations are equipped with



Wiring diagram, Chambly sub-station

kw.h. meters and a graphic meter for registering the consumption of the a.c. current.



Mr. Julius G. Koppel

Mr. Julius G. Koppel to whom we are indebted for the above descriptive article on two recently installed sub-stations for the Montreal & Southern Counties Railway Company, has until recently held the position of power house construction foreman for that company. Mr. Koppel was born in Germany in 1882 and is a graduate of the government School of Technology. He has served in the government naval yard as mechanical electrician and later had charge of the electrical end of the submarine torpedo boats. Since coming to Canada in 1907 he has been engaged with various manufacturers as mechanic and electrician. Mr. Koppel recently joined the construction department of the C. P. R. Company.

New Plant at Armstrong, B. C.

Armstrong, a recently incorporated city of fifteen hundred inhabitants situated in the north end of the famous Okanagan Valley of British Columbia has one of the most complete power and lighting plants to be found in Canada.

Normally the plant is operated by water power from Davis (or Fortune) creek, the water being utilized for domestic supply after giving up its energy to the turbine wheels. The creek having its rise in the higher altitudes of the Aberdeen Mountain is liable to great fluctuations in flow, the minimum being during cold weather when some of the smaller tributaries are completely frozen over. During this minimum flow period power is generated by Diesel engine, thus rendering a continuous service every day, including Sundays.

Since inaugurating the continuous service the power load has steadily increased, the average daily load factor being now fifty-four per cent.; load factor in this case being the ratio of average to maximum demand.

The power house, a reinforced concrete fireproof structure with Underwriters' wired glass windows and steel-covered doors, is located three miles from the city, the electric power, and domestic water supply, being carried over and under city right-of-way the intervening distance. The equipment of the power house includes the hydro-electric unit, oil engine unit with accessories, and switchboard.

The water-driven unit is composed of a Pelton wheel operating under five hundred and fifty feet head, with Pelton oil pressure governor, direct connected to a one hundred kilowatt Canadian General Electric generator running at nine hundred revolutions per minute. The two hundred brake horsepower Diesel engine is by Carels Freres, of Ghent,



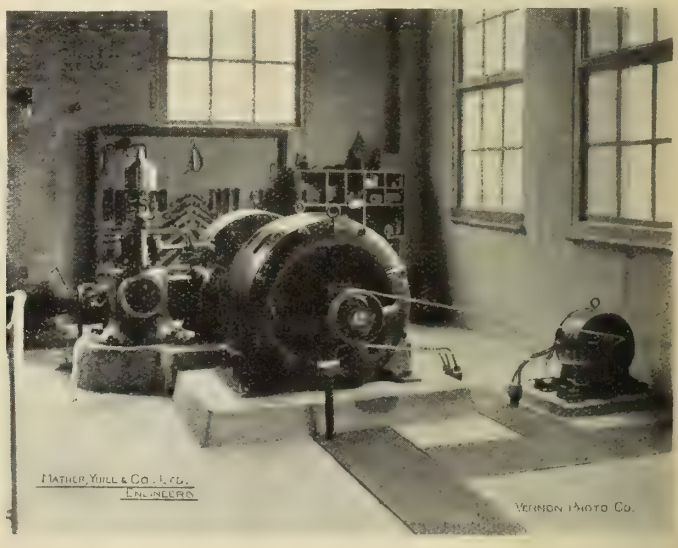
Carels-Diesel engine and Swedish generator.

Belgium, through Messrs. C. W. Stancliffe & Company, of Vancouver, and is directly connected to a one hundred and twenty-five kilowatt Swedish General Electric generator supplied by the General Supplies Limited, of Calgary. Both generators are three phase, sixty cycle, two thousand five hundred volts and are operated singly or in parallel. The switchboard of blue Vermont marble supplied by the Canadian General Electric Company, is composed of two generator and one feeder panels. All interior high voltage wires are of lead covered cable with G. & W. potheads.

The revenue from the electric plant for the last year was approximately eleven thousand dollars or over seven dollars per capita. A very considerable portion of this is due to the general use of fans and heating appliances. The system is entirely self-sustaining and is being extended to all agricultural districts within a radius of five miles, the ranchers being quick to seize the opportunity of improving their



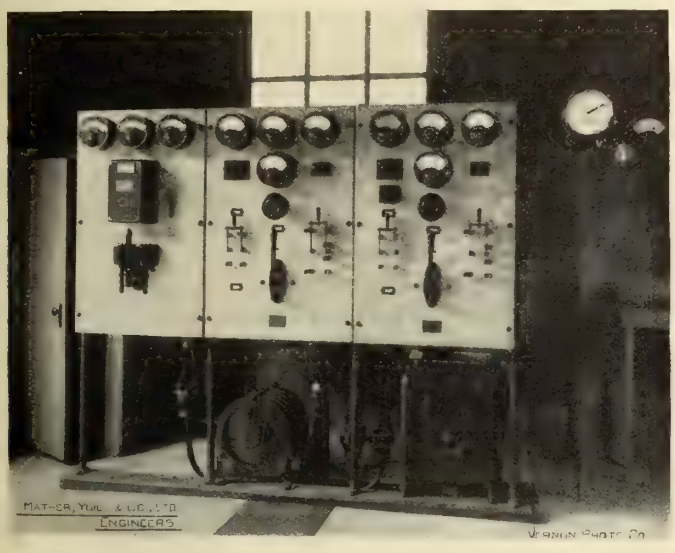
Municipal power house,—Armstrong, B. C.



Pelton water wheel and governor, Armstrong, B. C.

property and rendering home life more attractive to the younger generation.

The success of the installation is in a large measure due to Mr. J. M. Wright, the present and first mayor, and to Mr. T. K. Smith, chairman of the water and light committee. The superintendent of the electric light system is Mr. George



Switchboard, C. G. E. type, Armstrong, B. C.

Macnaughton. The consulting engineers for the city are Messrs. Mather, Yuill & Company, Limited, of Vancouver.

The domestic water supply of Armstrong is notably free from contamination, a fact that strangers in the city are not allowed to lose sight of. No irrigation is required in this district which is situated just north of the dry belt, the winter snows providing sufficient moisture.

Maritime Provinces Active

The city of Halifax is installing ornamental luminous magnetite lamps on some of the principal business streets. Orders have been placed with the Canadian General Electric Company covering fifty 6.6 ampere series type, with ornamental brackets and necessary station equipment. The Public Improvement League of Halifax had Mr. W. F. Winkeley of the G. E. Company give an illustrated lecture on lighting at a recent meeting of the city merchants.

Halifax, N.S.

The Public Utilities Commission have been meeting recently considering Halifax tramway matters. The Tramways Employees Union applied for an order compelling the company to equip cars with air brakes. No decision has yet been given. The company applied for permission to issue $600,000 more stock. This has been refused by the Commission who maintain that not enough information had been furnished by the company as to what the money is required for. This extra information is being furnished by the company.

Truro, N.S.

The new corporation lighting plant will be in operation by November 15th and when completed will be most modern in every way. The principal streets will be lighted with ornamental iron standards carrying each three sixty watt lamps enclosed in 12-inch Alba globes. The wiring is carried underground in lead covered cable. Wheeler fixtures with radial wave reflectors will be used on the poles for side and back streets. Four hundred of these and fifty standards will be used. Three 10 kw., 4 ampere transformers are being installed, the ornamental lighting being operated from series circuits through S.L. current transformers. The power plant is being installed in the town pumping building and will consist of a 50 kv.a. 2,200 volts, 3-phase, 50-cycle generator, with exciter, direct connected to a Robb vertical single cylinder engine operating at 400 r.p.m. The plant was designed and is being installed by Mr. C. McDonell, town engineer, the apparatus being supplied by the Canadian General Electric Company.

Broughton, N.S.

The Cape Breton Coal, Iron & Railway Company are planning on installing an electrical equipment in their collieries. Two units of 1,000 kw. capacity each will be installed. Mr. C. J. Coll is the general manager.

Amherst, N.S.

The Canada Electric Company have now in operation their new 1,000 kw. Curtis turbine. They have also completed a new transmission line from their Chignecto power house to sub-station at Amherst. This line is built for 22,000 volts, using number 2 hard drawn copper cable. A new equipment of transformers is being installed in the sub-station. The old equipment, which has become too small, is being moved to Joggins Mines to supply current to the pumps and hoists of the Maritime Coal, Railway & Power Company in their mines. The electrical equipment was furnished by the C. G. E. Company. Mr. M. A. Sammett of Montreal is the consulting engineer.

Sackville, N.B.

Negotiations are being carried on between the corporation of Sackville and the Eastern Electrical & Development Company whereby the town hopes to acquire the light and power plant of the company. The company is asking $65,000 for their plant and franchise.

New Glasgaw, N.S.

Many favorable comments are heard regarding the lighting of the Eastern Car Company's new plant. The building is 1,400 ft. x 1,000 ft. and is lighted by 100 C. G. E. flame arc lamps. These lamps operate separately on 110 volt, 60-cycle multiple circuits and are spaced one hundred feet apart and suspended 28 ft. from floors. Opal inner and clear outer globes are used and with white carbons the lighting of the building is practically daylight. Mr. F. W. Snyder the car company's electrical engineer designed the lighting system. The Canadian Car & Foundry Company, Amherst, N.S., have installed the same style in their new steel car building plant, their building being similar in construction to the Eastern Car Company's building.

Charlottetown, P.E.I.

The Charlottetown Light and Power Company have sold out their business to the Maritime Trust Company and a new company, The Charlottetown Electric Company, has been formed. The city council had employed Mr. C. H. Wright, of Halifax, as consulting engineer and had made an offer of $96,000 for the entire plant, this being at the rate of 123 per share. The ratepayers at a public meeting turned this proposition down, however, and the company then sold out to the Maritime Trust Company at a price of 120. The new company is issuing bonds and $150,000 of common stock. It would look as if the city of Charlottetown had lost a very good opportunity.

Stellerton, N.S.

The Acadia Coal Company are installing an electric pumping equipment in their Vale colliery and are building an 11,000 volt transmission line from Stellerton power house to operate same. The line is eight miles long, number 6 hard drawn bare copper wire being used. Transformers at both ends of line are three-phase units of 250 kv.a. capacity. The

(Continued on page 55)

Importance of Correct Factory Lighting

By M. H. Flexner and A. O. Dicker*

The aim of this paper is to bring out a few of the most important factors entering into the design or re-design of a lighting system for the factory. It is somewhat discouraging to the illuminating engineer to read article after article dealing with the methods used to raise the sanitary condition of the factory and when all has been read he asks himself "What about the lighting?" Ventilation, cleanliness, devices of safe operation of machines, rest rooms for employees are all discussed, but little or no attention is given the lighting. It is the hope of the authors that this paper will emphasize the fact that factory lighting is a subject dealing directly with sanitation and that it should be considered as such. Why is the lighting important, and whom does it affect? Does it mean a benefit for the central station only, or is it of equal benefit and importance to employer and employee? It seems just as reasonable to ask why should a factory be ventilated or why should it ever be cleaned up. The owner or manager would immediately say: "If I do not ventilate the work rooms the operators will become dull and lose interest in their work." Regarding his lighting conditions he knows naught and his answer to a question relative to his lighting condition, would very likely show that he never gave it much thought. This is just the man who needs some information regarding lighting. He does not realize that just as many of the headaches are caused by poor lighting in factories as there are from poor ventilation. This is not intended to belittle the importance of good ventilation, but is only mentioned to emphasize the fact that general improvement of condition does not end when a factory has been properly ventilated or properly cleaned. It does not end until the lighting as well as these have been considered. One is just as important as the other, since injury to the eye from poor lighting causes suffering equal to or even greater than the sickness caused from poor ventilation. In considering such vital subjects this country seems to be far in the rear of countries on the other side. We're behind the times, so to speak, and have not kept pace with France, England and other European countries, who are protecting their workmen, along these lines.

In 1912 the French Government appointed a Committee on Hygienic Aspects of Illumination, composed of prominent physiologists, oculists, engineers, physicists, and inspectors of factories. The main object of this committee are:

(a) To study, from the standpoint of general health and its effects on vision, the various methods of artificial lighting now used.

(b) To determine the composition and quality, from a hygienic standpoint, of the different combustible illuminants, and to examine the effect of prejudicial gases and the amount of heat developed thereby.

(c) To fix a certain amount of artificial illumination to the normal requirements of vision.

(d) To study the most practical methods of measuring illumination.

(e) To formulate recommendations governing the best means of applying customary methods of lighting to the chief varieties of industrial operations.

(f) To present to the Ministry a report on the subject of short sight and impairment of vision, and on the best methods of guarding against the cause of myopia.

It is the result of the investigations of such committees that awaken the mind of the manufacturer to the necessity of providing good lighting.

The first question that might be asked is: What is good illumination, or what is practical illumination? Can we spot a unit or cluster here or there, put a drop light over the working places in a slip-shod sort of maner and expect to be satisfied with the results; or, is it a matter of knowing what to expect from each means of illumination and its corresponding reflector and to fit in these units to meet the conditions in the factory? Our common sense dictates that it is the latter. Our experience teaches us that the problems involved are often difficult of solution and that we must have definite ideas about correct illumination before we attempt to accomplish satisfactory results.

One authority defines good lighting as any system which does not attract attention to the means of illumination, or cause one to wonder how the illumination was obtained. An analysis of this yields the following requirements for good lighting:

First, that sources of high intensity must not be in the field of ordinary vision; second, that the amount of light be sufficient for the work to be done; third, that the distribution of light be uniform or as nearly so as possible, and fourth, that the color be pleasing to the eye. By adhering to these principles, we will not go far wrong in laying out lighting installations, whether for factory or for home, being assured of good illumination.

Good Light Means Good Work

The value of good illumination should not be under-estimated. Some are contented to travel along in the old time worn ruts and to leave well enough alone. Many believe that as long as there is light, whether good or bad, the question of lighting is settled, and that the results obtained are as good as any light could produce. This is the wrong idea, but nevertheless it is entertained by many managers and officials of factories under whose jurisdiction the question of lighting comes; however, they must realize sooner or later the value of better operating conditions, produced by good lighting. To do work, light is necessary; with a little light, a little work can be done and with more light more work can be accomplished. This is very evident, and it is easily seen that no matter how a shop is lighted, if it can be better lighted, better or more work must result in a definite per cent. increase in efficiency of the workman.

What if our Mr. Official had to go home to a dimly lighted dining room? How would he like to read a paper which necessitated straining his eyes, or shave in little or no light, with his face very near the mirror and his eyes fixed in a staring position. It would not be very comfortable and he could hardly give himself much of a shave; yet under these conditions he expects his men to work, to turn out good work, and make his factory an efficient one.

There are such things as good and bad lighting installations, and to the progressive official the best should not be too good for his men. However, the initial cost is given first consideration and is the one stone that lies in the path of all changes, and therefore we can but sum up the reasons why it is worth every cent that is asked in making a lighting installation a good and efficient one.

Statistics have shown that, as the result of better illumination and a decreased strain on the eye, the physical condition of the workmen is better, they are better satisfied, imperfections in the work have been materially decreased and the factory output increased from 8 to 15 per cent.

Not only is the general physical condition of the workman improved by better lighting but his liability to accident is greatly decreased. Recently published statistics show that during those months of the year in which artificial lighting

* Read before the I. E. S. Convention, Pittsburgh.

must be used, there occurs a greater number of accidents than in the light months. The saving made by good lighting in this line alone will often more than repay the extra cost of installing and maintaining the lighting system. It has been said that a man who is obliged to keep one eye on the danger points of a machine has only one eye left to operate it. This is unquestionably true and consequently a machine must be made absolutely safe. The factory manager usually tries to accomplish this by putting a guard rail around the danger points or else enclosing them entirely. This seems about as reasonable as putting a rail around a hole in a street without placing a lantern on it. Protected machines still cause accidents and will continue to do so until the proper light is provided and the danger point brought well into view. Accidents are becoming more expensive each year and disregarding all humanitarian arguments an owner can no longer neglect to protect the operators from accidents. Good light is the most effective protection that can be provided and only carelessness on the part of the employee will incur accident under these conditions. "It costs us a lot of money, but it has paid for itself in less than a year" said one manufacturer. What more can an owner want? Certain courts have held that failure to illuminate danger points constitutes "contributory negligence." Germany, Austria, Holland and France, realizing the importance of good lighting conditions, have included lighting in their codes for factory inspection of health and safety.

In the installation one must take into account the position of the machines, the work that is done, the location of posts, the windows, and in fact every condition which may in some way cause deep shadows and bad illumination. The scope of this paper does not allow us to enter into any detailed account of layouts. As stated in the introduction, we are only attempting to emphasize the necessity and advantage of better factory lighting.

Good Lighting An Easy Matter

Good factory lighting is not beyond reach; it is not something that one can only wish for. It is a material thing and may be had for the asking.

A great many bad installations can be made good ones by two inexpensive methods; either re-locating the units and the addition of proper reflectors, or in some cases by replacing existing units with some of the modern efficient type now on the market. It is not hard to show that the new system will, within a given time, pay for itself, and in a great many cases save money over the operating and maintenance expenses of the old system.

Assume that the owner of a factory depends solely upon the profits of the work his employees turn out. An equation expressing output must involve the personal equation of the men and there must be a certain personal efficiency of each man under every condition in which he works. If a high priced man is placed under poor working conditions his work will be no better than the low priced man under good conditions. A manufacturer will usually buy a labor saving device or a machine with which his workers can turn out more or better work, and he will supply his employees with tools of the highest grade steel and have men to keep these tools in the very best condition; but he often absolutely ignores the personal efficiency of the operator and the conditions under which he must work. He does not usually see all the methods of making the man as perfect as his tools. In other words, more time and thought is given to the tools than the operator. What good is a perfect tool or machine if the operator can hardly see what he is doing with it? This sounds ridiculous, of course, but it is true of many a factory to-day. For instance, a manufacturer purchased a certain machine at a cost of $18,000.00 and paid a high priced man of long experience to operate it. Yet this owner could not see his way clear to spend $19.00 in order that this high priced operator would not have to take the product twenty feet away to the window to caliper it. This shows how little the owner considered the personal efficiency of his men.

The cost of illumination as compared with an operator's salary is very small and insignificant; in fact, so small that the manufacturer can not see it at all. The following data, taken as average conditions, shows this.

If a 100-watt lamp is assumed for each man and that it burns 3½ hours per day for 300 days, the following is derived:

Cost of lamp (Commonwealth Edison Co. renewal)		$0.00
Cost of reflector		1.00
Cost of wiring per outlet		4.00
Total first cost		$5.00
Interest on investment 6 per cent.	$0.30	
Depreciation at 12½ per cent.	0.70	$1.00
Power at 5c.		5.00
Cleaning at 3c. per mo.		0.36
Renewal of lamps		0.00
Total		$6.36

Wages for 10 hours a day, 300 days, may be assumed to be $1,000.00. Thus the ratio of the cost of furnishing illumination to a man under the above conditions would be (overhead expense not included), $\frac{6.36}{1,000}$, or 0.636 per cent.

The following mathematical deduction shows what good lighting would mean to a factory upon the installation of such a system. Taking an area of 30,000 square feet with an average of 0.75 watt per square foot, a connected load of 22,500 watts would result. Figuring the installation with 250 watt units an estimate of the first cost is surprisingly low:

90 250-watt outlets at $3.50	$315.00
90 fixtures at $1.25	112.50
90 reflectors at $1.00	90.00
90 lamps (Commonwealth Edison Co. renewal)	0.00
Total	$517.50

Let it be supposed that this factory turns out a yearly business of $250,000 and that 33 1-3 per cent., or $83,333.33 of this business is done under artificial light. Assuming a conservatively 5 per cent. increase in output as the benefit due to good lighting, the business is then increased $4,166.67. If there is a profit of 20 per cent. on this output a credit of $883.33 is derived, which is considerably more than the installation cost.

As further proof of the low installing and operating costs of good lighting the following data are submitted from a table compiled from actual figures on three trial installations in a large factory with lamp prices, etc., revised so as to be up-to-date.

100-Watt Tungsten Lamp

30 reflectors at 92c.	$27.60
Wiring at $3.22 per outlet	96.60
30 lamps at 0.72	21.60
Total	$145.80
Interest on investment at 6 per cent.	$8.75
Depreciation on reflectors at 12½ per cent.	3.45
Depreciation on wiring, etc. at 5 per cent.	4.83
Renewals at 30 × 900/1000 hrs. × 0.621	16.77
Energy 3000 × 900 hrs. × 1.1c.	29.70
Labor (cleaning 30 × 0.63 × 20 c.)	3.78
Total annual cost	$67.28

These figures are derived on the assumption that good factory lighting will necessitate a 100-watt lamp for 100 square feet of working area required by an ordinary workman. With these assumptions the following information has been tabulated:

Total working hours 300 × 10		3000 hours
Total lighting hours 300 × 3 1-3		1000 hours
Average cost of labor per hour		35 cents
Labor—		
3000 hours at 35c.		$1,050.00
Light—		
Cost of 100-watt tungsten lamp (Commonwealth Edison Co. renewal)		$0.00
Cost of metal reflector (trade price)		1.00
Average cost of wiring per outlet		3.50
Initial investment per outlet		$4.50
Interest at 6 per cent. on $4.50	0.27	
Depreciation at 12½ per cent. on $4.50	0.56	0.83
Cleaning 12 mo. at 3c.	0.36	
Lamp Renewals (Maintenance)	0.00	0.36
Energy 100 kw.h. at 5c.		5.00
Annual operation cost		6.19
Annual wages for one man		$1,050.00
Cost of light in per cent. of wages		.59

When reduced to cost per hour based on 3,000 working hours per year, one finds:

Labor per hour	$0.35
Light per hour	0.00619
Cost of light per day	0.02063
Cost of labor per day	3.50

These figures go to show that the cost of good lighting is a very small portion of the cost for a man's time; in fact, if good lighting would save five minutes of a man's time per day a material gain would be experienced.

By following this form, any local conditions causing different prices than those given can be substituted so that a comparative figure can be obtained for any particular locality.

The cost of maintenance of tungsten lamps and reflectors is stated as follows in Vol. 1 of the 1911 Proceedings of the National Electric Light Association.

	Per Cent.
Renewals of lamps	75
Renewals of broken reflectors	3
Labor making renewals	0
Changing reflectors for washing	16
Labor for washing reflectors	2
Additional indirect charges	2
	100

This data is from experience with an installation of between 7,000 and 8,000 lamps and reflectors.

With the available units, it is impossible to pick out one lighting unit and say that it can be used for all conditions. There is no one cure for all evils. Individual conditions enter into the problem and the resulting unit must be best for the conditions presented. The most important qualifications are the following: Efficiency; color; quality, arrangement of machines—processes; adaptability; special architectural features; and available hanging height.

The best unit to use will be the one that best fulfills these requirements. Each light source, whether gas arc, individual gas, electric incandescent, arc or vapor lamps, has its definite field in factory lighting. Usually where one should be used the others will be less satisfactory. It is hard to convince the owner that the cheapest is not the best, for he usually wants light only, and often will not pay for the necessary equipment to produce illumination. The problem of which one to use depends upon the class of work to be done under it, as each lamp has certain characteristics that argue for and against its use.

The last few years have brought great developments in the arc lamp. The flame arc of long life, furnishes a light source of high candle-power and low maintenance cost. When the white light-giving carbons are used the light emitted is of good but rather variable color. This lamp should never be used in the normal range of vision. It is best adapted to factories with high ceilings, as the intrinsic brilliancy of this light source is 5,000 candle-power per square inch.

There has been considerable talk about the harmful ultra-violet rays emitted from arc lamps. These rays are no doubt given off to a considerable extent, but they are lost in the inner globe. Therefore this characteristic should not be an argument against the arc lamp. The greatest objection to this light source is its steadiness, and for fine accurate work a more steady unit might better be used.

The mercury-vapor lamps are particularly well adapted to certain kinds of manufacturing. The peculiar color together with the high visual acuity renders them very useful. A large clothing manufacturing concern has recently replaced enclosed arcs with vapor lamps in pressing rooms. It is remarkable the way scorching can be detected under this lamp while if a tungsten lamp is used the scorch is not so noticeable. The vapor lamp has met with decided approval in this kind of work. This goes to show that the unit used should depend entirely upon the work to be done.

Keep Lamps Clean

In installations where the tungsten lamp is the source of light, too much emphasis cannot be put on the subject of cleaning. The manufacturer would not allow his operators to leave their machines at night without cleaning them; the floors are cleaned and each morning the factory is found in tip-top shape. Why? So that the work may begin under the best conditions, all working toward an increase of output. In other words, everything but the lighting equipment is systematically taken care of. The owner knows that the time and money spent in cleaning a machine is well spent, and yet that which has a greater effect on the efficiency of the operator is left to accumulate dirt from day to day and in many factories from month to month.

In general, it is best to have the light source as high as possible above the working plane. If it is out of reach of the worker, he cannot handle it and thus it will be free of a coating of oil or other dirt. Truly enough, certain machines require drop cords in setting up the work or changing the dies, but few machines actually need drop cords during their operation. One big railroad shop in Chicago has adopted Cooper-Hewitt lamps for general lighting and drop cords are checked as any other tool. In this way they are taken care of and are not used except when necessary. It has been our experience that the worker will use a drop cord as long as he has one in front of him.

The first move for efficient lighting is general illumination, where possible, doing away with the drop cord or as above stated, making the drop cord a working tool.

There are many combinations of efficient lighting systems; in fact, it is a subject of its own, so that we will not attempt a discussion.

Realizing the general disregard of good lighting as a necessary and important part of the factory equipment, and not overlooking the attractive lighting load of this class of service the Commonwealth Edison Company of Chicago decided to make a proposition covering lighting installations for factories.

As has been stated, the first cost of the installation is

too often the only obstacle, and therefore this company decided that the first way to make such a proposition attractive was to do away with the first cost. To insure most efficient operation the company includes in this proposition the cleaning and renewing of all fixtures and lamps.

The Commonwealth Edison Company's proposition is as follows:

The customer is asked to sign a contract for a period of twenty-four consecutive months. After the expiration of this period, the wiring and fixtures become the property of the consumer.

The charges for this service are made up on the following basis: rental charge, maintenance charge and electricity charge.

Rental Charge.—The rental charge is twenty-five cents per fixture per month, allowing the consumer to use either 100, 150 or 250-watt units in each fixture. At the end of the two year period this equipment becomes the property of the consumer and this charge is discontinued.

Maintenance Charge.—The consumer pays the company twenty-five cents per fixture per month, except during the months of June, July and August. At the end of the two year period, the consumer may elect to discontinue paying this charge and take care of this equipment himself.

Electricity Charge.—For this service the consumer pays our regular schedule. A rate which is ten cents net per kilowatt hour for the first thirty hours use of the maximum demand per month and five cents net per kilowatt hour for all energy used in excess of this amount.

The fixture supplied under this contract is one that was especially designed for this class of service. It consists of a shallow reflector with a collar containing a lock socket; the conduit serves as a stem. The reflector is so designed that the filament does not extend below the bottom of the reflector. Photometric curves show extensive characteristics. The idea throughout was to make a reflector that was efficient, plain, and easily cleaned.

The Commonwealth Edison Company confidently expect to install 10,000 of these fixtures within the next year, and a report of the first few months gives reason for the confidence expressed.

In summing up we believe that the campaign for good factory lighting has just begun and that the best argument in favor of better illumination is a statement showing the benefits derived from an efficient lighting system and the experiences of others.

Even a hasty reconsideration of the arguments presented in this paper demonstrates the tremendous scope and possibilities along this line. There is no longer any excuse for poor lighting; the necessity, the practicability, and the economy of good illumination have been demonstrated beyond question and if the strides in this direction which have been made in the recent past may be taken as an index of those which will be made in the future, there is no doubt that very soon the time worn phrase "a badly lighted shop" will have disappeared from the vocabulary of those connected with the lighting industry.

We believe that if a fair and broad-minded manufacturer will but figure out in a common sense way the merits and necessity of good illumination, he will be converted to its use in a short time. If his own figures do not satisfy him, let him consult those who have been far-sighted enough to go ahead with his better sense dictation and be shown, if necessary, the truths of the above assertions. He will realize sooner or later the needs of his men—better atmosphere, lighter and cleaner shops, and proper illumination.

The Council of St. Hyacinthe, P.Q., has passed a by-law granting to C. McCuaig & Company, Montreal, a franchise to supply the district with electric light and power.

Personal

Mr. C. R. Hosmer has been elected president of the West Kootenay Power & Light Company, succeeding the late Mr. W. M. Doull.

Mr. Guy H. Morton, manager of the Calgary office of the Canadian Westinghouse Company, has been appointed lecturer in electrotechnics by the technical education committee of the Calgary Board of Education.

Mr. C. H. Tillett has been appointed in succession to Mr. R. A. Becker, resigned, supervisor of signals on the eastern lines of the Grand Trunk, having charge of interlocking plants, automatic signals, electric crossing bells, etc. His headquarters are in Montreal.

Montreal Notes

The Canadian Society of Civil Engineers, Montreal, have arranged for meetings of the electrical section on December 4th and March 19th, 1914. Mr. R. M. Wilson is chairman, and Mr. J. C. Smith vice-chairman of the section.

The Montreal Council have passed a by-law forbidding the erection of poles or lamp posts and the stringing of electric wires along or across public places without special permission of the city.

The City of Montreal have received tenders for the supply and erection of a 35 kw. generator, direct coupled to a steam engine. This is required for electric lighting purposes at the low level pumping station, Point St. Charles.

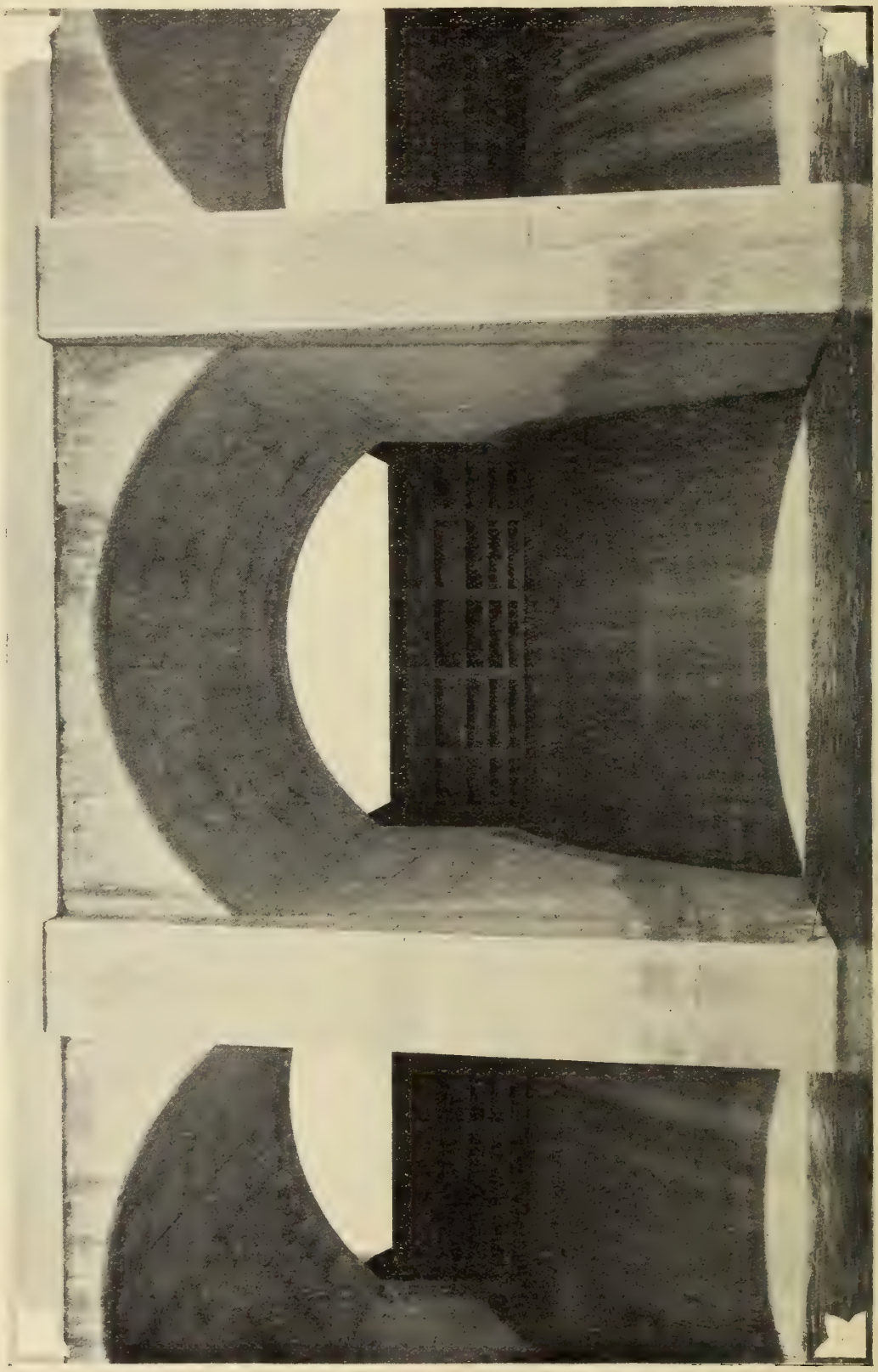
The Quebec Development Company, Limited, incorporated under a Federal charter, with a capital of $2,500,000, has for its objects the acquisition of water rights, the manufacture of electric machinery, the erection of plants and generating stations, and the building of underground subways. The head office is in Montreal, and it is understood that American capital is behind the project.

A deputation from Valleyfield headed by J. O. Mousseau, provincial member for Soulanges county, have had an interview in Montreal with the Minister of Lands in the Provincial Government, Hon. J. Allard, and requested that Valleyfield be allowed to use water power from the St. Lawrence, near Couteau, with a view to generating electricity.

The Fire Prevention Company of Canada, Limited, Montreal, have been awarded the contract to equip the Quebec Provincial Government buildings and the new Provincial library, now being built with the Reichel automatic fire alarm signal system, which is electrically operated.

The electrical station at No. 1 elevator of the Montreal Harbour Commissioners is now being re-organised consequent upon an addition to the storage capacity. Further equipment has been purchased, the Canadian Allis-Chalmers, Limited, supplying three 250 kw. oil-cooled transformers, stepping down the current from 2,500 volts to 550 volts. The Monarch Electric Company, St. Lambert, P.Q., secured the contract for the panel board, the high tension panels numbering eight and the low tension panels 17.

The Dominion Government recently commissioned Mr. Leo G. Denis to investigate the water power conditions along the projected line of the Hudson Bay Railway. Mr. Denis has just returned from his trip and was recently quoted as saying that the conditions found there were not such as would indicate the possibility of this railway ever being operated electrically. Mr. Denis advises us, however, that his meaning was misconstrued and that he made no such statement about the difficulty in the way of operating this railway by electricity as was ascribed to him.



Mississippi River power plant, Keokuk, Iowa—Showing completed spillways, with gates in closed position.

Testing of Telephone and Telegraph Lines

A Series of Short Articles Based on the Author's Practical Knowledge and Experience—Applicable to Plant of Any Size or to Any Manufacturer's Equipment

By Mr. T. H. Nicholson

A large part of the testing of telephone lines is done by means of the voltmeter, and it is therefore necessary for us to know the principles involved in the use of this instrument, and the various methods that are used to combine several functions into one voltmeter.

The voltmeter, as its name implies, is an instrument for measuring the voltage of a source of current, or the difference of potential between any two points in a circuit. The deflection of a voltmeter, however, is also proportional to the amount of current flowing through it, and this in turn is proportional by Ohm's law to the voltage applied to its terminals, so that if we take an instrument having a full scale reading of 100 volts, and a resistance of 10,000 ohms, the current flowing through it when fully deflected must be by Ohm's law:—

$$C = \frac{E}{R} \text{ or } C = \frac{100}{10000} = .01 \text{ amperes}$$

If the instrument is of the uniform scale type, i.e., giving the same difference of deflection for the same difference of voltage throughout its scale, and when connected to another source of current the needle is only deflected half way, we know that only half the amount of current is flowing through it, and the voltage of the circuit must now be by Ohm's Law:—

$$E = C\,R \text{ or } E = 10{,}000 \times .005 = 50 \text{ volts.}$$

If we connect a resistance in series with the voltmeter and the first source of current—100 volts—and the deflection is again only half, we know the added resistance must be the cause of it. We also know that .01 amperes will give a full deflection and .005 a half deflection, so the resistance in the circuit must be:—

$$R = \frac{E}{C} \text{ or } R = \frac{100}{.005} = 20{,}000 \text{ ohms.}$$

Since we know the resistance of the voltmeter to be 10,000 ohms, the added resistance must be 20,000 — 10,000 = 10,000 ohms.

This relation is taken advantage of in the Wirechief's

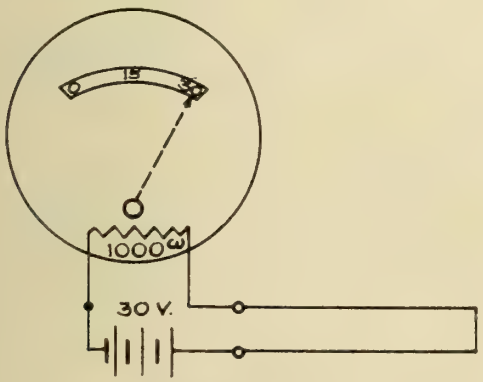


Fig. 10

voltmeter, and while the tester is apparently measuring the voltage he is really measuring the current, and from that calculating the resistance of the circuit. This is accomplished by maintaining the voltage of the testing battery at a point equal to the full scale of the voltmeter, and calculating the resistance of the circuit from the difference of deflection obtained under the different conditions. The values for the deflection to each graduation of the instrument can, of course, be calculated, and many up-to-date wire chiefs have the scale of their instruments laid out in terms of resistence instead of voltage, so the voltmeter is then virtually converted into a direct reading ohmmeter.

As demonstrated above, the voltmeter deflection is directly proportional to the amount of current flowing through it, and when the voltage of the testing circuit remains the same the only reason for the change in deflection must be

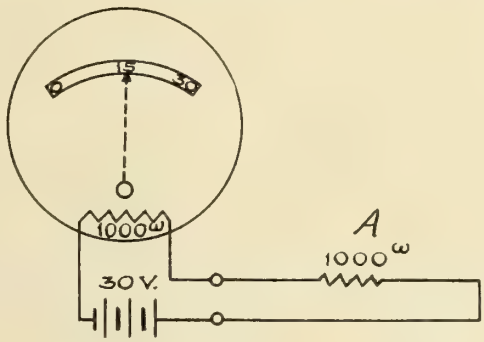


Fig. 11

a change in resistance. Assuming a uniform scale as explained, the deflection is inversely proportional to the resistance in the circuit, so that the number of times the first or full scale deflection is greater than the second is the number of times the second resistance is greater than the first.

This is clearly shown by reference to Figs. 10 and 11. In Fig. 10, with a voltage of 30, a full scale deflection is obtained, indicating that the only resistance in the circuit is that included in the voltmeter itself which may be taken as 1000 ohms. In Fig. 11 with the same voltage a deflecton of 15 only is obtained, indicating that the circuit contains twice as much resistance as in the former case. The resistance of the voltmeter itself remains the same, so the lesser deflection is due to external resistance. By the rule given above the total resistance must now be twice the former, since the former deflection is twice the latter. The former resistance was 1000 ohms, that of the voltmeter itself, while the latter by applying the rule is,

$$\frac{\text{Full scale deflection}}{\text{Observed deflection}} \times 1000$$

or $30/15 \times 1000 = 2000.$

To find the value of external resistance the resistance of the voltmeter must be subtracted from this total, i.e., we have 1000 ohms left, which is the resistance of the coil A in the circuit. The complete calculation then, to measure resistance R with a voltmeter is included in the following formula:—

$$R = \frac{D}{d} - V - V$$

Where D = Deflection on short circuit.
d = Observed deflection while testing.
V = Resistance of voltmeter.

To obtain accurate results the deflection on short circuit should correspond with the full scale deflection of the instru-

ment, that is, with a 30 volt meter a battery giving as nearly 30 volts as possible should be used. This is best determined by connecting up the voltmeter and battery as shown in Fig. 10 and allowing the current to flow under these conditions for a few minutes and adjusting the battery to suit.

Telephone System in Birks Building, Vancouver

First and most important among the buildings of to-day are the office buildings. These structures, ranging from three storeys upward practically cover the business district of every large city. The ground floor is usually taken up by stores and banks, and all above that by the individual renter. In the event of a larger section being needed the inter-connecting doors furnish a satisfactory suite. It will easily be seen that this type of building is the most difficult the telephone engineer meets. How to obtain a system flexible enough to meet this ever changing demand, to provide a separate system of single outgoing lines one day, or a combination of one, two or more stations on a single line the next, is one which requires a very careful study in order to avoid heavy future expenditure and numerous alterations.

In order to meet the possible ultimate capacity of the ten-storey Birks Building, in Vancouver, a 3 in. iron pipe was laid from the manhole in the alley at the rear of Vancouver Block to the basement of the Birks Building, and a 300 pair 22 gauge paper cable was pulled into the basement, terminating in a large splice on the right hand side of the main terminal box.

At the point in the building where the cable enters, a box, 44 in. x 50 in. x 5 in. was placed so that the pipe and cable to the manhole fell in the upper right hand corner; the box was then equipped with 300 pairs of lock nut strips for



Fig. 1.

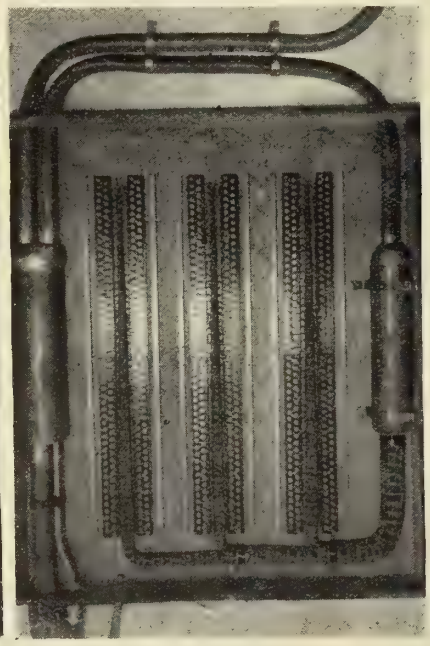


Fig. 2.

the terminating of 150 pair of exchange and 150 pairs of riser cable as described later, Fig. 2.

From the splice in the right hand side of the box a 300 pair cable was pulled up through the riser shaft to the 4th floor, at which point a straight splice, Fig. 1, was made, 4 30 pair and 1 10 pair silk and cotton insulated cables taken out, to feed the first five floors. From the splice on the 3rd floor a 150 pair cable continues up through the riser shaft to the 7th floor, terminating there in a splice, from which four 30 pair silk and cotton cables are taken out to feed the upper four floors. These 30 pair cables terminate on lock

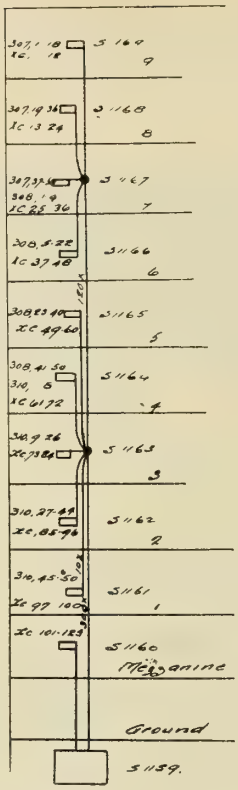


Fig. 3.—Riser Cable

nut strips placed in pressed steel boxes, one on each floor. The Henry Birks Company, Limited, are to occupy the ground and first floors, their private branch exchange being on the mezzanine of the first floor. To carry their lines to the P. B. X. a 30 pair cable terminating in the cross connecting box is run through a 1-in. pipe to a box placed alongside the P. B. X. This cable will be noticed in Fig. 2 coming out of the splice on the right-hand side of the box.

In order to enable the cable from the building back to the telephone exchange to be worked as efficiently as possible, 150 pairs of the 300 pair cable into the building are spliced straight through to the riser cable in the splice on the right side of box, and the other 150 pairs of exchange cable are spliced into the 300 pair branch cable which terminates in the cross connecting box. The remaining 150 pairs of the 300 pair riser cable are spliced to the 300 pair branch cable going to the cross connecting box. By this method, each 30 pair terminal contains 15 pairs which terminate at the telephone company's exchange, and 15 pairs which terminate in the cross connecting box in the basement of the Birks Building.

As the Birks Building will probably need about 200 lines, this system allows the B. C. Telephone Company to feed 150 direct from the exchange and cross connect all the rest, probably a few more than 50 pairs. The Telephone Company can then use the other 100 pairs of the 300 pair cable from the exchange elsewhere.

In order to reach the telephone in each room, twisted pair rubber covered wires are run in conduit from the telephone in each room to the terminal box on each floor, requiring approximately 24,000 feet of wire to complete the installation in this building.

Forest Telephones in B. C.

Construction of telephone lines is a chief feature of the work of the Provincial Forest Branch in British Columbia. Several lines have already been constructed and a number are about to be built. This year the forest branch has been making an examination of the province in general to determine those areas which are accessible and into which it is important that telephone construction should be completed without delay.

Two distinct classes of telephone lines are necessary for fire protection. The first class involving a greater mileage is built from some point where communication already exists, such as a town or railroad, up through an extensive timbered valley where there is no communication. The idea of this class of telephone line is to make it possible for fire guards out on patrol to send in word of any fire which they cannot control themselves, and to have assistance and supplies sent out to them for fire fighting to avoid loss of time that would result if it were necessary for them to ride or walk to the nearest settlement. Lines of this class are being built in the interior of the province from Sparwood up to Elk River about seventy miles, from Revelstoke up the Columbia River about seventy miles, from Howser up the Duncan River about twenty miles, and from Grand Forks up the north fork of the Kettle River about sixty miles. There are also under con-

sideration in the Coast district as well as in the interior, lines totalling about six hundred miles and which it is expected will be built within the next twelve months.

Telephone lines being built for forest fire protection are being constructed of as heavy a material as possible, No. 9 wire is used throughout, pole lines are avoided, the wire is strung on trees on split tree insulators; the insulators are attached to the trees with No. 18 seizing strand; this seizing strand is used because it has been found that the No. 12 wire previously used for this purpose crystallizes, twenty-five hundred o.h.m. ringers are used throughout.

Although three or four expert linemen have been engaged temporarily for the supervision of the work, a greater part of the work is being carried on by the forest guards who would otherwise be unemployed. All expenses of the work are met from the forest protection fund which is contributed equally by the government and by the timber owners of the province for the protection of the forest from fire. These telephone lines are so useful to lumbermen and to others interested in forest protection that in several instances the Forest Branch has received valuable assistance in the building of the line. The Elk River Lumber Company is undertaking to furnish all the labor necessary for the construction of seventy miles of line in the timber in which the company is interested. Mr. A. B. Buckworth, of Vancouver, has also furnished similar assistance in the building of a line near Salmo. The municipalities of Vernon and Armstrong have contributed towards the cost of a line which will improve fire protection on the watersheds furnishing the municipal water supply. Similarly some of the irrigation companies in the Okanagan district have contributed towards the construction of a line designed to protect their watersheds. The Dominion government is bearing the full cost of thirty miles of line which the Provincial Forest Branch is constructing through the railroad belt north from Revelstoke.

The second class of telephone line is that built from the headquarters of the district forester, forest ranger, or fire warden to some look-out point commanding a view of a wide stretch of timbered country. One such line, nine miles long, connects the headquarters of the district forester at Cranbrook with the summit of Mount Baker in the Kootenay district. From Mount Baker a man on look-out may secure an uninterrupted view of twenty-five or thirty miles in every direction. The man on lookout will be able to cover as much country as half-a-dozen forest guards on patrol and will further have the advantage of being able to telephone the district forester instantly at the first sign of fire, whereas a patrolman would probably lose half a day in getting news of fire to headquarters. Three other lookout lines have been built, one from Creston to the summit of Goat Mountain, one from Vernon to the summit of B. X. Mountain, and one from Kelowna to the summit of Little White Mountain. Additional lookout points are being examined and lines will be built to the most important of these next season. It is probable that the line to the summit of Mount Baker is the highest in British Columbia, the telephone instrument at its terminus being at an elevation of 7,200 feet above sea level.

Whenever possible, communications are made with commercial lines, such communications having been made for almost every line constructed. The terms are of course the most advantageous that can be agreed upon with the local companies. The line from Heriot Bay to Shoal Bay on the coast will require the use of about three miles of deep sea cable. This cable will be laid across the narrow channels in which there is a constant tidal current.

Maritime Provinces Active

(Continued from page 47)

motors used on pumps are of 225 h.p. each, operating at 3,250 volts, 25-cycles. Multigap lighting arresters will be used at both ends of the line. The electrical equipment is being supplied by the Canadian General Electric Company and the pumps by the Wilson Snyder Pump Company, Pittsburgh, Pa.

New Castle, N.B.

The corporation of New Castle are considering the operation of a twenty-four hour service. A new bridge being erected across the Miramichi river will require thirty horse power to operate it; also several new industries in the town are asking for power. The inauguration of a day system will necessitate an additional generator and engine at the power house.

Halifax, N.S.

In connection with the construction of new docks and terminals at Halifax, quite a large amount of electrical equipment will be used. At present the contractors have installed seven portable air compressirs of Ingersoll manufacture each direct connected to 3-phase, 5½ h.p. C. G. E. variable speed motors. These outfits are used in connection with rock drills. Several other motors of twenty h.p. are used in work shops for sharpening drills, etc. At present power is being furnished by the Halifax Tramways Company.

New Waterford, N.S.

This town has had a most remarkable development. In three years it has grown from a settlement of a few hundred to an incorporated town of 7,000. Until recently the town has had a rather make-shift lighting system but now, however, a company has been formed. The Waterford Utilities, Limited, who are installing a modern light and power distribution system. Power will be obtained from the Dominion Coal Company's lines at 6,600 volt, 25-cycle and transformed to 2,200 and 110 volt at the local sub-station. Later on a separate power plant will likely be installed.

New Castle, N.B.

Construction of the new wireless station for the Universal Radio Syndicate, Limited, is now well under way and the manager expects to have same in operation before December 1st. This plant when completed will be the most powerful wireless station in the world and is being built to operate with a similar station now being erected at Ballybunion, Ireland, the distance between being 2,700 miles. The company's engineer believes that it will also be able to send and receive messages with San Francisco station. The power house is being built of concrete blocks and will be 60 ft. x 50 ft. with a height of 30 ft. to the eaves. Installed in this power house will be two three cylinder Diesel oil engines each 225 h.p. direct connected to three 150 kw. 700-1,000 volt direct current generators. There will also be installed in the power house a storage battery of sufficient capacity to light all buildings on the premises. These will be charged from a motor-generator set. The switchboard will consist of five panels, switching arrangements being made to operate generators either in multiple or series. The power-house is being equipped with a travelling crane, also a gas producer plant. The operating building is located about 1,000 ft. from the power house, the cables of 250,000 c.m. area being carried there in underground ducts. The Poulsen system will be used at this station. In connection with the sending apparatus an arc is employed which will require 100 kw. to operate it. The aerial wires will be suspended between seven towers. The main tower will be of steel five hundred feet high, triangular shaped and fourteen feet in diameter at the bottom. The other six towers will be constructed of Georgia pine, 300 feet high. Between these towers will be stretched 125,000 ft. of stranded silicon bronze wire making a complete net work, while below ground, in trenches, will be laid 150,000 ft. of 3-16 soft copper cable. The different buildings and towers cover 55 acres and when completed will present rather an imposing appearance. Mr. E. W. Sawyer is resident engineer for the wireless company. Messrs. Galbraith & Cote, of Montreal, have the contract for erection of towers.

Electric Railways

Self-propelled Gasoline-Electric Car now being operated by the Edmonton Interurban Railway Co.

The Edmonton Interurban Railway Company have recently placed in operation a car of the self-contained type, a photograph of which we reproduce herewith. This car is 48 ft. in length, 8 ft. 8 inches in width and is divided into engine room, smoking and first class compartments. The total seating capacity is 46; total weight 62,000 pounds. The car is lighted by storage batteries charged directly from a generator installed for that purpose.

This represents the fourth car of the self-propelled type to be operated in Canada, the others being on the line of the Victoria and Sydney Railway (one) and on the Quebec and Lake St. John Railway (two). The first three cars are of the C. G. E. type.

The Edmonton Interurban Railway Company's line connects Calder, a village that is surrounded by the city of Edmonton, and the town of St. Albert, seven miles distant.

This car was supplied by the Drake Railway Automotrice Company, of Chicago and Paris, France. On the European continent this make of car is used extensively, one syssem alone in Hungary numbering seventy.

Briefly described, the car may be compared with a modern interurban trolley car, but with trolley removed and a power plant installed in the forward end of the car. The car body, trucks and traction motors are essentially such as are regularly adopted in interurban work. The power plant consists of a multi-cylinder gasoline engine direct-coupled to a 500 volt electric generator. These two units are mounted on one continuous sub-base which in turn is bolted to the car floor or frame. From this group the energy generated is conducted to a control system comprising series-parallel connection of traction motors with field regulation of generator and a varying carburetor throttle. The gasoline supply is carried in two tanks cross-connected and arranged so that either may deliver fuel to carburetor by gravity. The cylinder jackets are supplied with cooling water which is circulated by a positive geared pump, driven by the cam shaft. The cooling effect is obtained by passing the hot water through a copper tube radiator placed on the roof of the car. In winter a portion of the jacket water is circulated in the radiating pipes of the car heating system.

Straight and automatic air brakes are installed in a manner usual to interurban electric cars. A full complement of whistles, foot gongs and conductors' signals are provided.

The series-parallel control is essentially the same as used in tramway practice. The contacts for ten steps of field resistance are incorporated with the series and parallel sections of the controller. The control lever is also arranged to open or close the gas admission mechanically, thus permitting a wide range in the accelerating and running speeds.

The motors are usually mounted on the forward truck and are chosen from standard types according to duty required. One of the features of the gasoline-electric automotrice which appeals strongly to the practical railway manager is that the traction motors are standard, the controllers are of usual type, with but slight alterations and the generator of such type as to insure long life and minimum repairs. The only portion of the equipment for which comparative maintenance figures are not available is the engine. This unit in turn has now been so revised and refined in the several years severe, though successful European operation, that the matter of maintenance may be safely estimated.

The engine is designed nominally for 950 to 1,000 r.p.m. Equipments of 90 and 140 horse-power rating are supplied with standard cars seating from 44 to 72 passengers, depending upon the floor plan and seating arrangement adopted. The smaller of these equipments is intended for use where the schedule speed is approximately 25 miles per hour and the maximum on level tangents is 35 miles per hour. The larger equipment is for use where the schedule is based on approximately 30 miles per hour and a maximum speed of 40 miles per hour with capacity for hauling a trailer suitably designed for 40 to 60 passengers. A daily mileage of 150 to 175 miles may readily be taken as an average under ordinary conditions. Local conditions, however, always control total mileage.



Gasoline-electric car operating on suburban line out of Edmonton, Alta.

Montreal Tramways Improvements

As already stated in the Electrical News, the Montreal Tramways Company are engaged on a very extensive scheme of improvements, in order to meet the enormous expansion of traffic. At the beginning of the year the directors appropriated $3,750,000 for new equipment and renewals, in addition to large sums for maintenance. The programme, as mapped out, cannot be finished this season, but the company will have spent before the snow comes about $3,000,000 of the sum allocated.

Major Hutchison, the manager, states that the company have laid seven miles of new track, and have renewed twenty miles of track in the principal streets of the city, besides improvements scattered all over the 270 miles of the entire system. In the track that has been renewed they have replaced the rails of 87 pounds to the yard with steel rails weighing 116 pounds, and have laid these in solid concrete above crushed stone, with far more ties than were formerly used. The company now have a roadbed in the principal streets which is the equal of any in the world. Fifteen new intersections have been laid and 38 old ones renewed, and in every instance where possible the company have put in clearance curves so that cars can pass each other on the curves. When those now on order have been laid, these clearance curves alone will relieve the congestion on busy lines like Craig and Bleury by 50 per cent.

As to the rolling stock, Major Hutchison states that 100 more cars are in operation than at this time last year, making a total of 775 cars. This means an added carrying capacity of much more per 100 cars than the average, as all the new cars are heavy ones of very large capacity. These new cars have cost over $8,000 each. The company are now getting new cars delivered at the rate of four per week, and they are all being put into service as soon as they arrive. There are yet 250 cars on order. The large repair shops at Youville enable the company to overhaul the cars quickly; each car is renovated once a year.

Experiments have lately been made with a view to changing the color of the cars. It has been found that the light yellow paint becomes shabby, especially on the steel cars, which seem to rust through and discolor the paint. It is likely that the color of all the cars will be changed to green with cream and gold trimming. The color of the suburban cars has already been changed to orange which enables them to be easily distinguished. Another inovation is that all the new cars have ventilators which are always open and so designed as to give ventilation without draught.

The company are at present working out the details of a plan which will result in a perfected traction system especially in the outlying districts. The completed extension will cover a wide area and will further relieve the central congestion and inaugurate a rapid and frequent service to the most remote districts.

Ottawa Street Railway Extensions

An extension of the Ottawa Electric Railway was opened last week to Ottawa South, thus adding about three miles of tracks to the present system. The new line extends from the former terminus at the Exhibition grounds on Bank street.

The opening of the new line was made the occasion for a little ceremony in which all the members of the city council, a committee of prominent residents of Ottawa South, and some of the directors and officials of the O. E. R. took part. Two new cars took the party from the City Hall over the new line, which goes over the new Bank street bridge, to Sunnyside avenue, then down Sunnyside, Seneca, and Grove to Bank street, at a point within less than a quarter of a mile of the city limit.

A luncheon was served on Dr. Graham's lawn, provided by some of the residents in Ottawa South, at which toasts were proposed by ex-mayor Charles Hopewell. To the toasts of the Ottowa Electric Railway, Mr. Thomas Ahearn, President of the company, and Mr. Warren Y. Soper, Vice-President, replied. Mr. Soper referred to the growth of the Ottawa Street Railway and recalled the time when Mr. Ahearn and himself drove the first cars on Bank street as far as the Exhibition grounds 23 years ago. At that time Ottawa had a population of 35,000 and less than 100,000 people were carried on the cars in that year. Now, he said, the city's population is 100,000 and over 25,000,000 passengers will be carried this year.

The construction of the new line cost about $50,000. Other extensions on Preston street and in New Edinburgh will be opened early next month.

Artistic Passenger Station

The British Columbia Electric Railway Company has just received tenders for the construction of a passenger station at the terminus of the Lulu Island Railway at Vancouver. The Lulu Island Railway is owned by the Canadian Pacific Railway Company, and is operated by the B. C. Electric under a long term lease. It extends from Vancouver across Lulu Island to Steveston, with a branch from Eburne to New Westminster. The section of the line between Vancouver and Eburne passes through a section which is a well-settled suburban district, from which arises commutation traffic, trains being run over this portion of the route during the rush hours at intervals of fifteen minutes. At the present time the Vancouver terminus of the Lulu Island Railway is located on the north side of False Creek, the



B.C.E.R. Lulu Island passenger station.

station being reached by passing over a long trestle bridge. Because of the increase of navigation in False Creek the draw span of this bridge is frequently opened, thus delaying traffic. The station itself is not situated to the best advantage for transfer to the city lines inasmuch as these lines, with a single exception, now run over the Granville street bridge, which at this point has an elevation of over thirty feet above the level of the interurban station.

The new Lulu Island terminal is located on the south side of False Creek, and on the west side of Granville street bridge. The level of the station is the same as that of the bridge proper, of which it will practically form a part. With the station in its new location, the interruptions of the service caused by the opening of the draw span of the False Creek bridge will be avoided and transfer from the interurban lines to several branches of the city system can be conveniently made. The station is located on the foreshore, thus necessitating a pile and timber construction for its support. This platform is 198 by 140 feet in size, and is now completed. The layout provides for the location of the station a short distance back from the line of the Granville street bridge. The interurban passenger trains will leave the Lulu Island railway track at Third avenue. Along this

street a double track line will be constructed to the station platform. At the rear of the station five tracks are provided for, accommodation of the regular trains and storage space for special cars, etc.

The station will be of the ornamental type, the plans calling for an attractive frontage in half timber and steel, with a clock tower over the central portion of the roof. The entire station will be 115 feet long, and 29 feet wide. The central 25 feet of the building is an open passage way in order to provide prompt and convenient facilities for the transfer of passengers from the interurban to the city lines. To the north of the passageway is located the main waiting room which is 29 feet square. This room will be of an ornamental type, having beamed ceiling, etc. Adjoining this room will be the ladies' waiting room and the news stand. The section of the building to the south of the passageway will be used for a general ticket office and the offices of the staff connected with the Lulu Island division. The building will be fitted throughout in a tasteful manner, the architectural appearance of the Granville street frontage being particularly attractive by reason of the heavy timber brackets supporting the roof and the ornamental beam work in connection with the stucco.

While definite figures are not yet available, the estimated cost of the new terminal will probably be in the neighborhood of $40,000.

Metallic Sand Spout

Electric traction officials and car builders are manifesting considerable interest in a spout known as the J-M Metallic Sand Spout which it is claimed will outwear any other form of spout on the market. This device consists of a remarkably strong metal ribbon wound spirally, the edges being crimped, or turned in, during the winding, forming a continuous interlocking metal spout that can be bent to the desired curve without fear of fracture. The spout withstands a crushing strain of 300 lbs. to each four turns of its spirals, and can not break square, flatten or bend beyond the give of its interlocking metal spirals. Therefore leaks are impossible —a very common occurrence with ordinary coiled wire spouts which readily kink and leave an opening that gradually enlarges, permitting the sand to leak out. Ordinary spouts, if accidentally caught, unwind with little resistance, and are likely to whip around and injure anyone standing close to the car. As the J-M spout withstands a pulling strain of 1,000 to 3,000 lbs. it can not unwind if it strikes an obstruction.

This spout is supplied either in stiff or flexible form so that it can be set rigidly in any position or adjusted to sand the curves. It is furnished with plain couplings or with couplings for either DeWitt or Ridlon sand baxes. Standard diameter 1⅝ inches; lengths 30 inches and 36 inches. Special sizes made to order.

Ontario Municipal Railways

Reports have been prepared by the engineering department of the Hydro-electric Power Commission of Ontario on the cost of constructing and operating radial lines from Toronto to Uxbridge on the north and to Whitby on the east. The general scheme embraces 71 miles of line which is calculated to cost approximately $2,500,000, or at a rate of $35,000 per mile. This mileage would connect Toronto with Markham (16 miles); with Uxbridge (20 miles); Markham with Port Perry (28 miles); Brooklin with Whitby (7 miles). Brooklin is a point on the Markham-Port Perry section. The engineers have provided, in the estimate, for a service not less frequent than every hour and three-quarters on every section of the line and as frequent as every fifteen minutes in the vicinity of Toronto. The probable operating revenue for the whole line is placed at $450,000, operating expenses $240,000, interest and sinking fund $155,000, leaving a surplus of approximately $55,000. Two other schemes were also suggested and figures given for a system covering a more restricted area.

Trade Publications

Compressors—Bulletin No. 34 T, issued by the Chicago Pneumatic Tool Company, descriptive of class M Corliss type steam driven compressors.

Circuit Breakers—Circular No. 1205, issued by the Detail and Supply Department of the Canadian Westinghouse Company, describing and illustrating carbon circuit breakers.

Condulets.—The Crouse-Hinds Company have just issued a new bulletin covering condulet types for railway requirements; also one covering radial switches and one covering roundhouse reflectors.

Glassware—Catalogue issued by the Elkins Glass Company, Pittsburgh. This catalogue contains a description with illustrations of the new "Vesta" glass, a product now being placed on the market by this company.

Translux—A catalogue issued by the Pittsburgh Lamp, Brass and Glass Company, describing their latest designs of bowl, semi-bowl, flared and ornamental ball and bowl types of glassware. The catalogue is well illustrated.

Wire Reels—A pamphlet issued by Mathias Klein and Sons, Chicago, manufacturers of lineman's and construction tools, describes a combined take-up and pay-out wire reel in a number of different designs for electric light, telephone and telegraph work.

Single-Phase Converters—Bulletin number 103 issued by the Wagner Electric Manufacturing Company, St. Louis, describing single-phase converters for changing single-phase to direct current required in such work as moving picture machines, battery charging, X-ray work, etc.

Polyphase Motors—Bulletin 160, issued by the Bell Electric Motor Company, describing their compensator type of polyphase motors. This is claimed to be the most advanced type of polyphase motor ever produced; highest in both power-factor and efficiency; no starting box or compensator required; entirely automatic in starting.

D.C. Motors—Bulletin number 150 describing direct current motors of inner pole design manufactured by the Bell Electric Motor Company, Garwood, N.J. These motors are of new and recent design. The use of the inner or commutating poles represents such marked improvement over the old design that they are claimed to be worth the extra cost of building.

Lighting and Wiring Devices—General catalogue No. 12. issued by George Cutter Company, South Bend, Ind. This is a 135 page book so classified and divided into schedules that all devices of a more general nature are listed together and it is possible to locate easily the piece of apparatus desired. The equipment covers street lighting equipments, panel boards, switchboards, wiring specialties, etc., etc.

Siemens Publications—Meters—a booklet containing instructions on the use of meters, with diagram of connections. A.C. Meters—a booklet describing alternating current watt-hour meters, with instructions as to their use. Polyphase Meters—a description of polyphase watt-hour meters for 3-phase current, including instructions for their use. G5 Meters —describing watt-hour meters for direct or alternating current, including instructions for use and diagram of connections. A booklet entitled Electricity Meters which is a general description of the various types manufactured by the Siemens Company; also a sheet entitled the Siemens Combined Unit and Demand Meters.

Illumination

Principles of Illumination

II.. Refraction

Rays of light travel in a straight line as long as the medium through which they are moving remains uniform and unchanged, but the slightest change in density or material causes the rays to change their course. If the second medium is uniform the rays continue to travel in a straight line in the new direction. For example, if a piece of glass is interposed in the path of a ray of light, RO, Fig. 1, the ray is caused to swing through a certain angle at the surface separating the two media, and passes out as OR_1 where the angle ROX is greater than the angle R_1OX_1. If the surfaces of the glass are parallel the ray will turn back to its original direction as it again enters the air, Fig. 2, but its path, though now parallel to its original path, has however been displaced as shown, the amount of displacement plainly depending on the thickness of the glass plate. If the sides of the glass are not parallel but are more or less prismatic in shape the phenomenon shown in Fig. 3 results. It will be seen, therefore, that with a varied arrangement of different shaped pieces of glass a very varied distribution of light is possible. This change of direction is generally described as a turning towards the normal, or perpendicular, to the common surface.

In general, the ray turns toward the normal if it is entering a more dense medium, and from the normal if it is entering a less dense medium than it is leaving. This is the only law that can be said to govern refraction, as the amount of the refraction varies with other properties of the substance as well as with its density.

Cutters of glass, precious stones, etc., make use of this

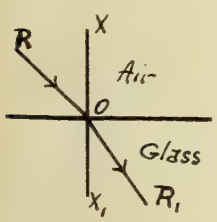


Fig. 1

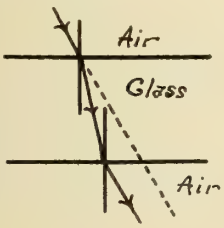


Fig. 2

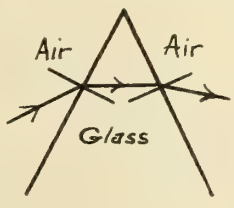


Fig. 3

property of refraction to obtain a sparkling effect and indeed the high monetary value of diamonds is the result largely of the property diamonds possess of refracting light through a very large angle. The diamond cutter by a clever multiplication of surfaces is thus able to produce refraction and internal reflection to such a degree that the diamond actually becomes a small ball of light and sends out rays in almost every direction.

Owing to difficulties met in manufacturing perfect reflectors, glass manufacturers have taken advantage of the property of refraction in directing and distributing rays of light. This product is known as diffusing glassware, the surfaces of which vary in construction from a combination of prismatic shapes (similar to that shown in Fig. 3) to a simple ground glass where the little unevenness, though too small to be perceptible to the eye, are yet sufficient to cause the necessary refraction.

Electric Train Lighting

What is claimed to be a very efficient system of train lighting is being placed on the Canadian market by Vickers Limited. This system, known as the Vickers Single Battery System, is self-regulating and automatic and is generally conceded to have attained as near to the ideal in electric train lighting as is practically possible without sacrificing simplicity and reliability in operation.

The mechanism of the equipment constituting this system is simple, strong and permanent, with very slight depreciation from wear. The equipment is claimed to contain fewer parts and to be less complex in its operation than any other system of carriage lighting, etc., and is entirely devoid of motor-driven regulating devices or intricate voltage relay controlling coils, which have been found far too delicate and complicated to properly perform the functions required of them. The regulating apparatus is, for convenience, carried from the carriage underframe, completely encased and protected from dust and dirt; there is no necessity to encroach upon the space inside the car. A dynamo is placed beneath the carriage and so adjusted that at a speed of, say, 10/15 m.p.h. it feeds the lamps direct, any excess current being stored in the battery for use when the train is stationary. The dynamo, which derives its power from the carriage axle, is automatically switched into circuit by the cut-out at the desired train speed, i.e., when it is generating an e.m.f. just in excess of that of the battery, the pressure being so controlled that at all speeds the current supplied to the lamps is uniform; the latter are prevented from receiving more than 24 volts by the resistance interposed in the circuit. When the car is at rest, and the cut-out has switched the dynamo out of circuit, the lights are supplied at 24 volts by the storage battery. Suitable provision is made in the dynamo for maintaining the correct polarity of the current for charging the battery whatever the direction of armature rotation.

The distinctive features in this system are the means employed for controlling the dynamo output and lamp voltage at all speeds, so that they shall always remain normal.

In the first case, this is accomplished by the use of a solenoid that operates when the dynamo is generating, and, with suitable mechanism, throws resistance in and out of the field circuit of the dynamo as the speed increases or diminishes. In the second case, when the dynamo is charging the battery its electromotive force rises; therefore, without some method of control the village would be come too high on the lamps, but in this system it is kept constant by means of a variable resistance in the lamp circuit. In order to preserve the battery and prevent an excessive charging current, the regulator operates to reduce the current to the normal charging rate when the lamps are turned off, all these operations being automatic.

For the protection of the batteries from overcharging,

a stop-charge switch is fitted on the regulator-controller. When closed by high charging voltage, it causes additional resistance to be introduced in the dynamo field, thus cutting down the dynamo output to about 5 amperes, in fact to any quantity required, and so affording full protection to the batteries, ensuring long life and efficiency with the minimum of maintenance cost. At the same time the dynamo, running on practically no load, absorbs little or no power from the locomotive.

Bank Illumination

It is said that the modern tendency of interior illumination of banks is to conceal the source of light in troughs along the top of the bank rails surrounding the tellers' cages, etc. One can appreciate that the entire absence of hanging fixtures will assist in a more uniform distribution. It also tends to give the interior of the building a high and spacious appearance for in the average installation the eye finds it difficult to see past the bright light, and the ceiling is visually lowered besides being unevenly lighted.

The accompanying illustration shows an interior view of the Swedish-American Bank at Balmoral and Clark Sts., Chicago. The main banking room is 52 feet long, 32 feet wide, and 26 feet high. The reflectors are contained in the



Properly diffused light.

casing on the bank railing which stands 9 ft. above the floor. It can be seen from the movement of the minute hand of the clock in this photograph that the exposure was about seven minutes. No light was used except that supplied by the general system of illumination. It is said that this installation is kept burning evenings solely on account of the attention it attracts and the advertising value it possesses.

The illumination is accomplished by two reflectors, carrying 60 watt lamps, contained in each of the eight boxes or troughs along the bank rail over the tellers' wickets, etc. In addition there are four reflectors using 150 watt lamps over the vestibule entrance. There are two skylights in the ceiling for day lighting purposes and these are also utilized at night by placing eight 100 watt lamps in suitable reflectors above the skylights.

This installation was made by the Pierce Electric Company, Chicago. The equipment used was supplied by the National X-Ray Reflector Company.

A by-law will be submitted authorising the expenditure of $10,500 for extensions and improvements to the electric light plant in Outlook, Sask.

Tungstolier Company Has New Showrooms

For the past several years the Tungstolier Company have not attempted to have any more than a sample room in which to show their fixtures; but since they are manufacturing in Canada, and their line has grown so rapidly, they decided to equip a real first-class showroom. The Tungstolier showroom is located on the fourth floor of the Canadian



Corner of the Tungstolier showrooms.

General Electric Company's building, corner King and Simcoe streets.

A specially prepared room is set aside for displaying semi-indirect fixtures where the ceiling is so arranged as to give maximum results. Each semi-indirect fixture has a separate switch so that these can be shown to the best advantage.

The Tungstolier Company have endeavored to cover practically all the field for high grade lighting fixtures. They wish to emphasize that their showrooms are for the use of the many dealers and other friends who have been handling Tungstoliers. They also anticipate that with this valuable addition to their organization many new friends and customers will be made.

Magnetic Handy Lamp

The Adams-Bagnall Electric Company are placing on the market a very handy type of lamp for use with automobiles or around machinery of any kind. The lamp is a low voltage type and is designed to operate from a storage battery. The specially handy feature about this new devise is a small electro-magnet with one end of the core exposed



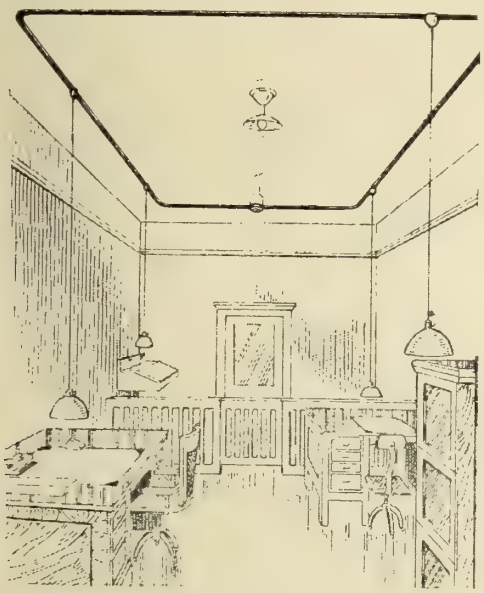
Will cling to any iron material.

so that by simply placing this core against any piece of iron the lamp is held firmly in place. On automobiles it will cling to the axle, springs, hood or a dozen and one other places where light is required in case of accident. One view of this lamp is shown herewith.

The Dealer and Contractor

Office Wiring Suggestion

The cut herewith shows a system of distribution with metal moulding which is designed to meet the requirements in rented properties where no two tenants specify the same amount or distribution of light. The circuit is picked up in



Good wiring arrangements for renting quarters.

this instance by a conduit junction box shown at the far end of the ceiling, and the ceiling was panelled with the moulding placed 16 inches from the side wall. Four flat elbows, and four rosettes complete the installation which was painted to match the ceiling. This makes a good job and also a good looking job.

Substations at Low Cost

The estimated cost of equipment with its installation has been the means of delaying the supply of light and power to many a promising customer. In this class may be included small factories, dairies and small towns which may be found in the neighborhood of practically every transmission line and where there is always considerable demand for electric current. For this class of business the out-door sub-station seems to possess many advantages over the old established system of housing everything, the chief advantages claimed being: 1, flexibility of operation; 2, low first cost; 3, ease of installation; 4, ease of inspection; 5, reduction of transmission losses on low tension feeders. The accompanying photograph illustrates an installation which is typical of a number recently made by the Transmission Engineering Company, of Pittsburgh, and which are said to be giving entire satisfaction. The photograph represents a 100 kv.a., 3-phase, 60 cycle out-door sub-station which is reducing the voltage from 22,000 to 2,200, 440,220, and 110. The small building to the left houses a rotary convertor, used in this particular case to supply direct current for mine service. Except in the exceptional case where direct current is necessary, all buildings can be dispensed with as, in the regular transformer equipment, no moving apparatus is required.

Perhaps the most interesting feature about this particular installation is its low cost, which, it is claimed, will not exceed $12.50 per kw. of installed capacity, the cost being distributed as follows:—

1 tower and equipment of switching and protective apparatus	$356.00
1 100 kv.a., 3-phase, 60 cycle transformer	850.00
Labor of erecting sub-station	44.00
Total cost of sub-station	$1,250.00

If to this is added the cost of 500 ft. of No. 4 wire, 3-phase, 22,000 volt transmission line, estimated to cost $200, the total cost of installation amounts to $1,450.

It is interesting also to note the probable income from an installation of this sort. On the supposition of a 30 per cent. load factor during a ten hour day, 300 days per year,



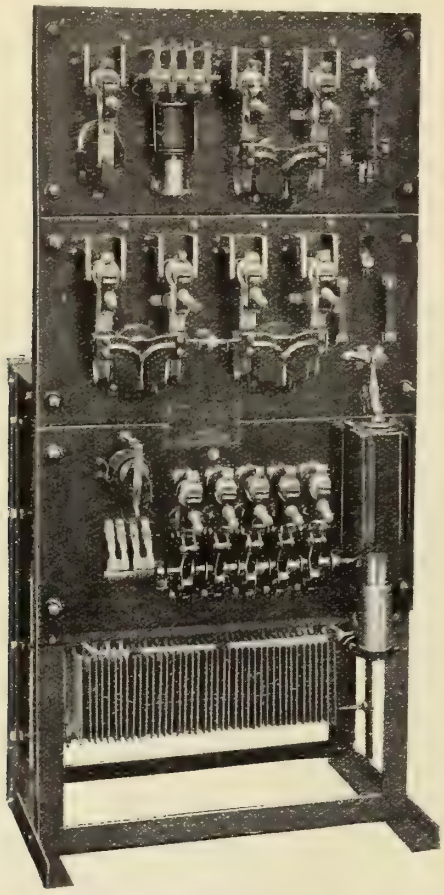
Out-door sub-station suitable for small towns.

the total power consumed would be 90,000 kw. hours. At 1½ cents per kw. hour the gross income would therefore amount to $1,350. Deducting 50 per cent. for operating costs and 15 per cent. for interest and depreciation, which appears ample in each case with this type of equipment, there is a net yearly profit of $450, which is slightly in excess of 30 per cent. on the original investment. Such an installation would therefore pay for itself in less than four years.

The Tweed Electric Light & Power Company are reducing their capital stock from $40,000 to $24,000.

Elevator Controllers That Insure Safety

In the elevators of the many hundreds of business buildings in the country millions of people are carried every day. When this great number is considered the feature of safety looms up as of greatest importance. Elevator accidents are particularly gruesome and it is unnecessary to say that the choice of elevator control equipment should be given the greatest consideration. In the design of the Cutler-Hammer full magnetic type elevator controller the control system is laid out so that even should grounds or short circuits occur in the cables or switches, no damage to the elevator or its occupants can result. Failure of any part of the equipment to function propertly results in the slowing down of the elevator and bringing it to a stop. The latest design of controller,



Full-Magnetic Elevator Controller Panel.

the panel of which is shown in the accompanying illustration permits of all the refinements of control that can be used in connection with direct current motors.

These standard controllers are furnished in either single-speed or two-speed types, both types being equipped with the slow-down feature. The single-speed types are used with motors that have no field control. The two-speed controllers are used with motors having additional speed variation by means of shunt field resistance. The slow-down feature is obtained in both cases by means of the combination of armature series and shunt resistances. The armature shunt resistance is used also for dynamic braking. Single-speed equipments are generally used for moderate speed elevators, while standard two-speed controllers are used with elevators operating at high speeds and this design of controller can be arranged for use with the very highest speed elevators possible.

The magnetic switches mounted on the slate control panel are simple and rugged in construction and can easily be taken apart for inspection or for renewal of the contacts. All switch arms have a channel section and the other parts are heavily ribbed where required so as to eliminate the breakage of any of these parts. All electrical contacts on these panels are "butt" type, carbon to copper. These contacts have a wide range of adjustment for taking up wear, thus insuring maximum life. Dust and dirt cannot collect on the contacts because they are vertical. The main contacts are equipped with magnetic blow-outs, the blow-out coil being of bar wound copper mounted on the back of the control panel, so that these coils cannot burn out nor be damaged from the arc itself. All of the wiring is exposed on the back of the panel and all terminals are accessible. A double-pole main-line switch breaks both sides of the line and in connection with the direction switches gives four breaks in the armature circuit. The direction switches are mechanically interlocked to prevent their simultaneous operation which would cause a short circuit on the line. These switches will automatically open on abnormal drop in voltage and stop the equipment. A double coil overload movement is arranged to stop the elevator in case of overload and can be automatically reset by throwing the car switch to the off position. This gives a reliable indication as to whether the car is overloaded and by having the resetting feature in the car switch, it is possible to set this overload within the closest limits. This device therefore possesses an advantage over the hand-operated circuit-breaker in that the operator is not compelled to go to the switchboard in case a slight overload occurs. The only thing necessary is to lighten the load on the elevator. With a manually operated circuit-breaker the operator, under these conditions, invariably increases the current setting of the breaker when he goes to the panel to reset it and, in case of continued tripping, eventually ties the breaker in; thus eliminating the overload protection which the circuit breaker is designed to give.

The Maximum Demand Meter

An interesting type of meter is being placed on the Canadian market by the Siemens Company of Canada, the purpose of which is to show, in addition to the kilowatt hour consumption, the maximum demand in watts or kilowatts averaged over some definite period of time; an indicator pointer always shows the highest value on watts demanded continuously, averaged on, for example, a fifteen minute basis. The following description and sketch will assist in making the construction and operation of this meter better understood.

The figure herewith is a diagrammatic sketch view, showing merely the essential parts and their relations, in order to make the description of the construction and operation clear. Referring to the drawing, the induction meter system of a single or polyphase meter is represented by the single armature disc and spindle A, and the meter brake or drag magnet Mg. The worm S, gears into the worm-wheel S_2, and drives the kilowatt-hour counter W in the usual way through appropriate ratio wheels. A pinion on the arbor of the worm-wheel S_2 gears into the wheel V, and on the arbor of V is fixed the wheel B normally in gear with the wheel M, thus forming the connecting link between the meter and the maximum indicator pointer Z.

The pre-determined time period is given by a timing gear consisting of a simple induction motor element E and armature disc B_1, driving a suitable train of wheels ending in the tripping cam C. The speed of this motor-driven timing gear is controlled by a hair spring and escapement Hs. The cam C is arranged to trip the rod RD, which rests up against the bar Ab, pivoted at P. The bar AB is so arranged that its movement controls the arbor of the wheels V and B, an upward movement of Ab serving to disengage the wheel B from the wheel M. To the wheel M is fixed a spring R, so that rotation of wheel M, when driven by wheel B, takes place against the tension of spring R, and if B is

disengaged by the upward movement of Ab, the wheel M returns under the pull of spring R to its zero position.

To the wheel M is fixed a carrier pin St, which serves the purpose of engaging and carrying with it the pointer Z against the friction of spring F, which exerts sufficient

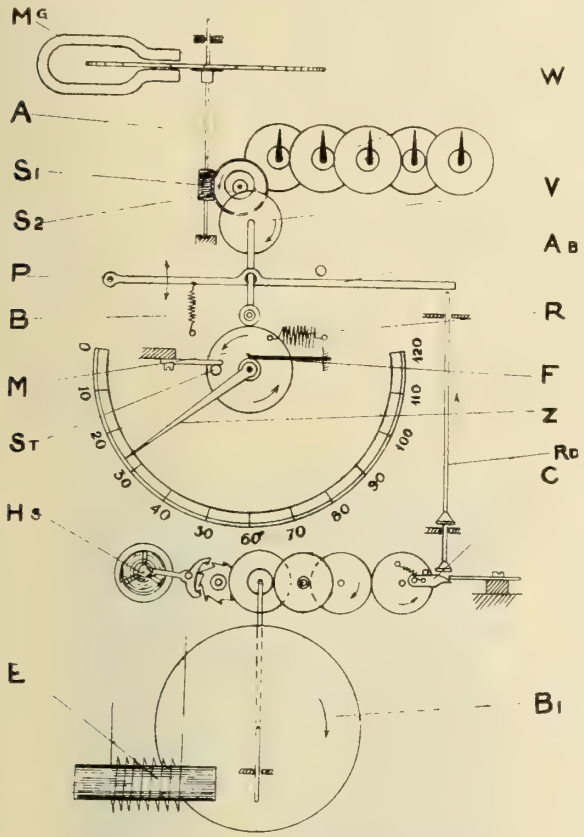


Diagram of maximum demand meter.

pressure to retain the pointer Z at any position it may be carried to by the pin St.

Method of Working

The rotation of the meter system A is through the worm and wormwheel S_1 and S_2 communicated to and registered by the counter W, which is geared to read direct in kilowatt-hours in the ordinary well-known manner; also the rotation of the meter system is communicated in the same manner to the wheel V by a pinion on S_2. Since the wheel B is fixed to the arbor of wheel V, the motion is further carried on to wheel M to which the pin St is attached. Assuming the pointer Z to be at zero on the scale, it will be clear that the rotation of the meter system will cause M to revolve, and so cause the pin St to engage and carry with it the pointer Z over the scale.

The motor driven timing gear, the speed of which is kept constant by means of the escapement device, controls the cam C through a suitable set of ratio wheels, which in turn trips the rod RD at some pre-determined and recurrent interval of time such as every 10, 15, 30 or 60 minutes.

The tripping of the rod RD will cause the lever bar Ab to momentarily lift, and so disengage B, allowing M with pin St to return to zero under the pull of spring R, leaving Z under the retaining friction of spring F to indicate on the scale the distance travelled by the pin St on the wheel M in the chosen time period. The tripping and disengaging is only a matter of a second of time, as immediately the cam C trips the rod RD, the latter is allowed to fall again to its normal position, so bringing the lever bar Ab back, which, in turn, allows the wheel B to engage again with M, and so repeat the cycle of operation.

It will be seen, therefore, that since the time period of engagement is constant and recurrent, the position of the pointer Z through the medium of the gear S_1, S_2, V and B is directly dependent on the number of revolutions made by the meter armature in the chosen time period. The result is that the position of the pointer Z is a measure of the maximum load averaged over the chosen time period.

G. R. S. Selectors on the New York Central

The New York Central Railroad has awarded the order for telephone selector equipment for their West Shore Line, Albany to South Utica, to the General Railway Signal Company of Rochester, N.Y. This circuit comprises 42 selector stations and is 118 miles in length, the dispatchers office being located at Albany. The order specifies G. R. S. power equipment, including an a.c.-d.c. motor-generator set and a power switchboard with accessories. The motor generator will be operated from a 25-cycle, 110 volt commercial circuit, which is available at the dispatcher's station. The installation will be the third circuit on the New York Central Railroad to be equipped with G. R. S. selectors and power equipment, since a trial installation, placed in service April 20th, 1912, and the sixth circuit to be equipped with power equipment.

Gasoline Torches

The accompanying illustrations are representative of equipment manufactured by the P. Wall Manufacturing Supply Company, Pittsburgh, Pa. Fig. 2 is a half-pint size and operates without a pump, generating its own gas by heat from the burner, and producing an intensely hot blue flame. This size is light, substantial and occupies small space in a mechanic's kit. For Fig. 3 it is claimed that never before has



Fig. 1.

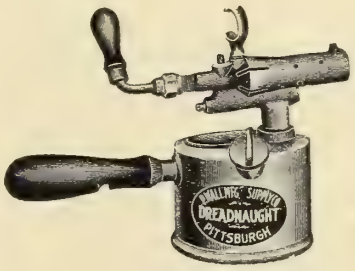


Fig. 2.

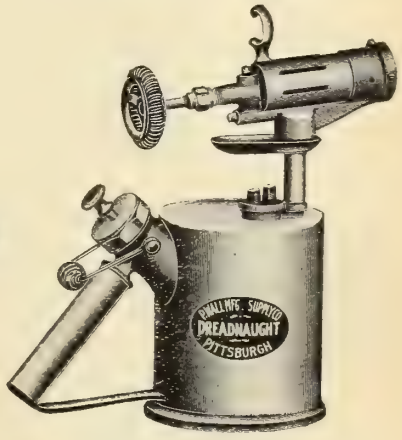


Fig. 3.

there been a blow torch that would produce such a variety of flames. Everything from a small pointed intensely hot flame to a powerful blow pipe flame is obtained by simply turning the needle valve. This is an ideal electric torch for soldering fine wires, for commutator work or heavy cables. Fig. 1 represents a conduit holder, another specialty manufactured by this company.

The Electrical Department of the H. W. Johns-Manville Company, New York, announces that it has recently completed the installation of lighting fixtures to the value of $19,590 in the New York Central R. R. Company's new station at Rochester, N.Y.

It is reported that the matter of the purchase of the British Columbia Electric Railway system by the city is being seriously considered by both parties.

Lecture on Illumination

In the absence of Mr. G. M. Gest, who is in England, and consequently deferred his promised paper on underground construction, Mr. C. A. Howe, of the Holophone Company, Toronto, addressed the members of the Montreal Electrical Society on October 17. Mr. Howe spoke on recent advances in illumination, tracing the development of electric lighting. He pointed out that illuminating engineers first of all studied the placement of lights, and then turned their attention to the quality of the light. Lately, engineers had been studying the subject of glare, and Mr. Howe remarked upon the efforts made to minimize this effect. He also spoke upon the advantages of direct and indirect lighting and gave the results of recent experiments in this direction. The Ontario Hydro-electric Commission were doing much to educate the public in the use of electric light by means of their window displays in Toronto. The speaker also described the process of manufacturing some of the shades he exhibited. Many questions were asked, Mr. Howe elaborating many of his points in replying.

The Most Resistant Wood

Genuine greenheart has the reputation of being the most resistant wood to the attack of marine borers and to decay. Borers are especially bad in tropical waters. The wood is, in addition, hard, heavy, and durable, and not subject to damage from impact and wear. Indisputable records show that the best grades of this wood surpass iron and steel as to lasting qualities in contact with salt water. It has been known and used since 1769. Logs have remained intact under water for one hundred years. Lock gates in English canals have been made of it for years, and the only limit of their durability so far has been the length of service of their iron bolts and fastenings, which usually can be renewed without much trouble. Greenheart in Liverpool lock gates built in 1856, removed to allow a deepening and widening of the ship channel in 1894, was used over again when the gates were reconstructed. The sills and fenders of the lock gates at Panama will be made of greenheart, and much of the docks will be constructed of the same material.

New Office of Cutler-Hammer Company

The Cutler-Hammer Manufacturing Company, Milwaukee, manufacturers of electric controllers, have recently opened a new district office in Cincinnati located in the Fourth National Bank Building. The general increase in business has made it necessary to establish a permanent office in Cincinnati. Mr. Horace L. Dawson, formerly of the engineering department of the company, and recently one of the sales engineers connected with the Chicago office, will be in charge of the new office.

Large Order for Rotary Converters

The Siemens Companies have recently been awarded further contracts in connection with the government electrification of the suburban railways of Melbourne, Australia. These further orders comprise eleven 2,000 kw. rotary converter sets complete with transformers, rheostats, diverters, starting gear, etc. This now brings the number of rotary converters in connection with this order up to the following:—25 rotary converters 2,000 kw. capacity each; 10 rotary converters 1,000 kw. each; and 4 rotary converters 500 kw. each. This probably represents the largest order for rotary converters ever placed.

The town council of Welland have voted another $20,000 to cover further extensions of the electric distribution system.

New Companies

The North American Development and Construction Company, Limited, has been incorporated with head office at Winnipeg.

Applications will be made to the Legislative Assembly of the province of Ontario at its next session to incorporate the London, Grand Bend and Stratford Railway Company.

A charter has been granted to the Southern Canada Power Company, head office Montreal. Mr. C. H. Cahan, Jr., son of the president of the Western Canada Power Company is one of the provisional board of directors.

Geo. C. Rough, Hercules

At the annual meeting of the Jovian Order held in New York City, October 14, 15 and 16, Mr. Geo. C. Rough, 512, of the Packard Electric Company, Toronto, was elected to



Mr. Geo. C. Rough, 512.

the office of Hercules for the Twelfth Jovian Congress 1913-14. At this annual meeting it was also decided to make Canada a separate district.

C. G. E. Publications

The Canadian General Electric Company have issued the following:—The Illumination of Construction Work describing the value of proper night illumination and its possibilities with the type W flame arc lamp. "Ivon clad-exide" Battery for electric vehicles, describing batteries and their accessories. Efficiency Round-house Lighting, a booklet explaining the proper type of reflectors, condulets, etc., required in the correct illumination of the round-house. Bulletin M, describing metal shades, mirror reflectors, border and footlight reflectors, portables, etc., manufactured by the Wheeler Reflector Company, for which the Canadian General Electric are Canadian agents. Condulets, manufactured by the Crouse-Hinds Company of Canada, are handled by the C. G. E. Company. Bulletin No. 101, deals specially with a new type of condulets for railway requirements. Bulletin 4972 describes the KR system of voltage regulation which is controlled in Canada by the Canadian General Electric Company.

Current News and Notes

Aurora, Ont.

A contract has been awarded to the Canadian Allis-Chalmers, Limited, for the supply of electric pumps required in connection with the town water system.

Ayers Cliff, Que.

It is reported that the electric light franchise, which has yet a number of years to run, has been purchased by the Sherbrooke Railway & Power Company.

Brandon, Man.

Work is in progress on the new car barns. Tenders will shortly be called for nine new street cars.

Brantford, Ont.

An extension of time has been granted the Grand Valley Railway Company in which to comply with the conditions of their franchise.

Brockville, Ont.

The town council has passed a by-law to expend a further $69,000 in the light and power department.

Calgary, Alta.

Tenders have been called for next year's supply of service transformers.

The Imperial Wire & Cable Company have been awarded the contract for the supply of 40,000 feet of lead-covered, paper-insulated underground cable.

Chatham, Ont.

The city council will secure an estimate from the Hydro-electric Power Commission of Ontario as to the value of the local plant, so that unnecessary distribution duplication will be avoided.

Dryden, Ont.

The Dryden town council have made a new agreement with the Dryden Timber and Power Company under which lower rates have been secured. The company is allowed the use of the transformers, cable, poles, etc., belonging to the municipality and gives the following rates:—8 c.p. carbon lamp, ¾ cents per night; 16 c.p. carbon, 1½ cents per night; 32 c.p. carbon, 3 cents per night; 40 watt tungstens, 3 cents per night. A discount of 10 per cent. is allowed on all accounts.

Edmonton, Alta.

The employees of the Edmonton Radial Railway system have formed an association for the study of first aid to the injured. At the first meeting 28 members were enrolled.

Superintendent Parsons of the power plant has recommended the purchase of a 400 kw. street railway generator to be operated by a Belliss & Morcom engine, with condensing equipment.

Forest, Ont.

A contract has been awarded to the Central Electric Supply Company for a quantity of insulated copper wire.

Fort William, Ont.

The Orpen Conduit Company are contemplating the erection of a factory in Fort William, Ont.

Contracts have been awarded for repair shop machinery to the A. R. Wiliams Machine Company, Mussens Limited, and the Canadian Fairbanks-Morse Company. The repair shops and car barns are being placed in readiness for the taking over of the local street railway system by the municipality, on January 1st.

Gowganda, Ont.

The Miller Lake O'Brien Mine are developing a series of rapids at the outlet of Gowganda Lake in the townsite of Gowganda. The total fall is 27 ft. in a distance of 2,300 ft. The dam will be about 100 ft. long and water will be delivered from there to the turbines by a 7 ft. diameter tubular wooden flume about 1,500 ft. in length. Two sets of Barber wheels each capable of developing 400 h.p. are being installed and these will be belt connected to a 750 h.p. generator.

Guelph, Ont.

The Hydro-electric Power Commission of Ontario will be asked to furnish estimates of the cost of an electric railway line connecting Guelph with Fergus and Elora. The line would run along the same right of way as the transmission line which it is expected will be built shortly.

Halifax, N.S.

The Canadian Westinghouse Company are supplying Acadia Sugar Refining Company of Halifax, N.S., with the following equipment:—three 750 kw. bleeder type, turbo-generator units, 3-phase, 600 volts, 7,200 alternations, 3,600 r.p.m.; one 11 panel switchboard for controlling the 3 turbo-generators, exciters, feeders, etc.; 45 a.c. 60-cycle motors having an aggregate capacity of 700 h.p.

Hamilton, Ont.

Engineer Sifton estimates that additional equipment to the amount of over $300,000 will be required in connection with the Hamilton distribution system.

The Dominion Power & Transmission Company have been granted a permit to build a freight shed to cost $5,000.

The Dominion Power & Transmission Company may erect a 40-pole extension to their electric light service in Mount Hamilton.

Kingston, Ont.

A petition of the ratepayers has been presented to the council asking that sections of Brock and Wellington Streets have all poles removed and wires placed underground as is being done on Princess Street at the present time.

Langham, Sask.

The town of Langham has recently installed a 50 h.p. producer gas engine generator set for supplying light to the town. The equipment was supplied by the British Canadian Engineering & Supply Company.

London, Ont.

Plans are being prepared by the Hydro-electric Commission on a fourth sub-station to be located in East London. Equipment will also be required.

The important question of the electrification of the London and Port Stanley Steam Railway was decided on October 22nd in favor of electrification, by the passing of a by-law authorizing the expenditure of $700,000 for this purpose.

Ottawa, Ont.

Ottawa & Hull Power and Manufacturing Company have decided to increase their power plant by the addition of two water wheel type alternators each 6,750 kv.a., 120 r.p.m., 2,300 volts, and also two transformers each 6,750 kv.a., 2,300/12,000 volts. The contract for this addition has been awarded to the Canadian General Electric Company, Limited.

Superintendent F. D. Burpee and R. A. Baldwin, of the

Ottawa Electric Railway, attended the convention of the American Street Railway Association held in Atlantic City, N.J., during the week of October 13th.

Owen Sound, Ont.

It is understood that the town council have decided to accept the offer of the Ontario Hydro-electric Power Commission to supply Owen Sound with 1,500 h.p. of electric energy to be supplied from Eugenia Falls.

Peterborough, Ont.

The city council has passed a by-law dealing with the expropriation of the Peterborough Light & Power Company's distribution plant. Unless the company is willing to accept $95,000 in payment for their property expropriation proceedings will be commenced.

Port Alberni, B.C.

The council is negotiating for the purchase of electric power from the Richie-Agnew Power Company.

The B. C. E. R. Company will install thirty 100-watt street lights here and maintain them at a monthly rental of $1.50 during the summer and $2.25 during the winter; lights to be extinguished one hour after midnight.

Quebec, P.Q.

The Battlefields Park Commission have awarded the contract for the electric lighting of Battlefields Park to the Quebec Railway, Light, Heat and Power Company. Previous reports of this contract being awarded to another company were premature.

Regina, Sask.

A contract has been awarded to the Canadian Fairbanks-Morse Company for the supply of the required pumping unit.

The operating returns of the Municipal Street Railway system for the week ending October 4th are as follows:—gross revenue, $3,650; passengers carried, not including transfers, 88,265. Corresponding figures for the week ending October 11th are $4,227.50 and 99,840.

Rougemont, P.Q.

The Canadian General Electric have obtained the contract for equipping the sub-station at Rougemont, P.Q., of the Montreal & Southern Counties Railway. The equipment consists of a 300 kw. motor generator set, a bank of transformers, high and slow tension switchboards, lightning arresters, and switching apparatus.

Saskatoon, Sask.

The City Commissioners have informed the Council that Saskatoon is in a position to supply the Dominion Government Interior Elevator upon which work has already commenced, with electric power at the low rate of 1.6 cents per kilowatt hour.

Sault Ste. Marie, Ont.

The Michigan and Lake Superior Power Company and the Algoma Steel Corporation are making application to be allowed to build a dam across the St. Mary River for the development of electric power.

Smithville, Ont.

Mr. H. Gracey, furniture dealer, is said to be considering the erection of a small gasoline electric plant with storage battery auxiliary. The maximum requirements to be in the neighborhood of 1,000 candle power.

South Porcupine, Ont.

The Dome Mines Company, Limited, South Porcupine, Ont., have awarded a contract to the Siemens Company of Canada for one 450 h.p., 250 r.p.m., 550 volts, 25 cycles, slip-ring type induction motor with short circuiting and brush-lifting device, pedestal bearing, together with a Siemens type liquid starter. The motor will be used to drive a Belliss & Morcom compressor.

St. Catharines, Ont.

On October 30th a by-law will be submitted asking authority to expend $116,000 on a distribution system. Of this amount $26,000 would be expended on underground equipment and its installation. On the same date a by-law will be submitted extending the franchise of the Lincoln Electric Light Company for three years.

Swift Current, Sask.

A contract has been awarded for the erection of the new power house to the G. C. Gillstrom Contracting Company.

Three Rivers, P.Q.

Shawinigan Water and Power interests are identified with a project for constructing an electric railway in Three Rivers, P.Q. The company will be known as the Three Rivers Traction Company, and propose to construct a line connecting the city with Berthier in the west and Portneuf in the east. The incorporators of the company are J. Aldred, Thomas McDougall, Howard Murray, Julian C. Smith, W. S. Hart, of Montreal, and Denis Murphy, of Ottawa.

Toronto, Ont.

Tenders have been called and will be received up to November 25th for one or more seven and a half million and twenty million Imperial gallon pumping engines; also three water tube boilers with piping and coal handling apparatus, to be installed at the high level pumping station.

The valuation on the Toronto Street Railway Company's system, as recently handed in, names $9,894,482 as the value of the physical assets of the company at the present time. By placing $10,713,553 on "intangible" assets, of which the chief is the franchise, the total value of the system is raised to $20,608,035. It is further estimated that the value of the radial lines within the city limits amounts to $336,486. The value of the Toronto Electric Light system has been placed at $6,132,754. The price placed on these two properties together by the owners is $30,000,000. This is in excess of the combined values of the physical assets of the two systems ($9,894,482, $336,486 and $6,132,754) by more than thirteen and a half million dollars.

Transcona, Man.

The city of Winnipeg have received tenders for three 600 kw. transformers for the G. T. P. shops here.

Contracts are called by the Commissioners of the Transcontinental Railway, Ottawa, for the furnishing and installing of the electric wiring requirements of the car shops at Transcona.

Welland, Ont.

The Electric Steel and Metal Company have called for tenders for the construction of four buildings at Welland, Ont.

Winnipeg, Man.

The Houston Company, Limited, electrical supplies, have opened a branch at Portage la Prairie.

Tenders will be received up to November 4 for switching gear and accessories required at Point du Bois.

Woodstock, Ont.

It is stated that before the first of December over fifty farms in the county of Oxford will be using electric power in one form or another. The uses to which power has been put includes threshing, silo-filling, wood-cutting, grain-chopping, milking and for operating various household appliances.

Yorkton, Sask.

The contract has been awarded to Messrs. Ritchie & Watters for the erection of a brick construction electric power house.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

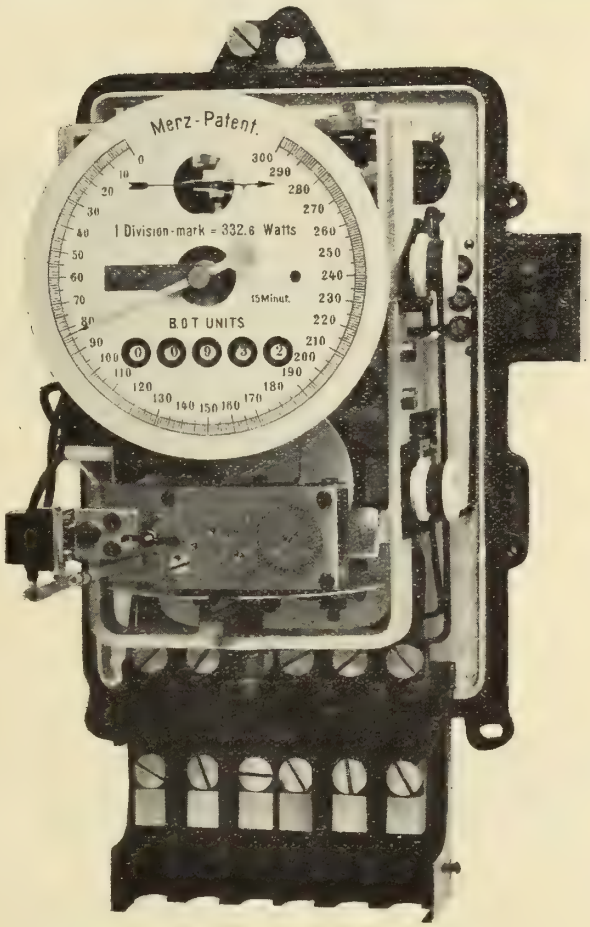
SIEMENS - SCHUCKERTWERKE | SIEMENS & HALSKE

SIEMENS

What the Meter does

1. Gives the kilowatt hours.
2. The highest load demanded in watts on a time average of say 15, 30 or 60 minutes.

The accurate measurement of these two quantities enables a true load factor system of charging to be adopted.



SIEMENS LOAD FACTOR METER
(Combined Kilowatt hour and Maximum Demand Meter)

What can be done with the Meter

1. Charge an annual sum per K.W. year or Horse power year to cover capital and standing costs.
2. Charge a low straight rate per K.W. hour based on running costs and profit required.

The RIGHT METHOD and the RIGHT METER.

Siemens Company of Canada, Limited

HEAD OFFICE:

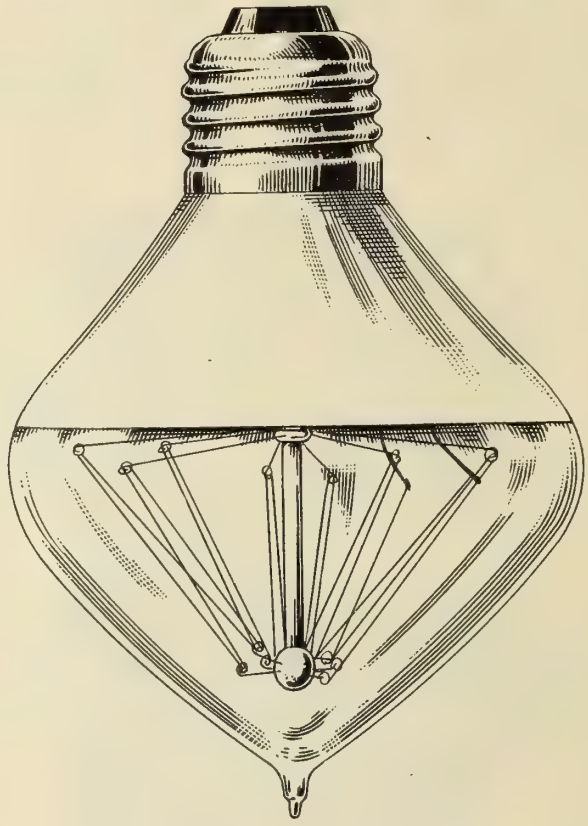
Transportation Building - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Laco Projector Lamps



400% More Useful Light with same Kilowatt Consumption

The Useful Candlepower of LACO PROJECTOR Lamps is the same whether lamps are burnt in vertical, horizontal or slanting position.

For further information see the Electrical News, Issue Oct. 15th—Pages 67-68 and write for prices, etc.

LACO - PHILIPS COMPANY

Montreal **Toronto**

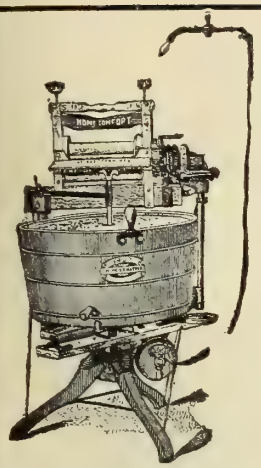
or

F. NICHOLAS & CO., LTD.

Selling Agents

Montreal **Winnipeg** **Calgary** **Vancouver**

LACO Lamps Last Longest



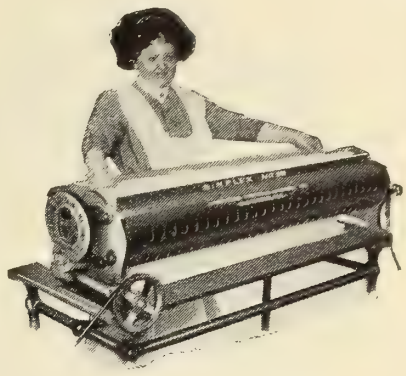
HERE IT IS!

The Electrical Solution of the Greatest Household Problem.

Every Electrical Dealer is invited to investigate. We have something worthy of your consideration in the

1900 Electric
Washer, Wringer and Ironer Outfit

See us at the Shows:
Montreal Arena, Nov. 1-8 Toronto Arena, Nov. 10-15
Make Yourself Known
H. B. H. MORRIS, Mgr.
The 1900 Washer Co., 357 Yonge St., Toronto



New Outlet Box Fittings



P & S 428 is a new outlet box fitting. It is designed for use on 4 inch boxes but may be used on 3¼ inch boxes.

The pull mechanism is contained within the receptacle itself.

Each receptacle is supplied complete with about 4 inches of chain, to which is attached 10 feet of cord with a ball at the end.

Although this receptacle has only been on the market for a few weeks, its success has been instantaneous and thousands have been sold.

The leading jobbers of Canada have this receptacle in stock now.

PASS & SEYMOUR, INC.

MAIN OFFICE AND WORKS:

Solvay, New York, U.S.A.

San Francisco—Rialto Building.



IT IS ABSOLUTELY ESSENTIAL

that your switch boxes should be waterproof, secure against tampering, and so constructed as to avoid danger in making connections.

The D. & W. fuse switch boxes have passed all these tests successfully. They are fitted with rubber gaskets to render them waterproof. They can be permanently locked after fuses are installed, thereby making them secure against tampering.

It is impossible to re-fuse the circuit when the switch is closed.

D. & W. Fuse Company

PROVIDENCE, R.I.

Selling Agent: **The Northern Electric and Manufacturing Co., Limited**

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

AMERICA'S HEADQUARTERS

for Second Hand Electrical Machinery

Send for our "Monthly Bargain Sheet" showing complete list of machines on hand with net prices. Every machine sold is completely overhauled and fully tested at our works before shipment, and is sent out practically "as good as new." t.f.

We Buy, Sell, Rent, Exchange and Repair.

GREGORY ELECTRIC CO. CHICAGO, ILLINOIS

Established 1893

Positions Wanted

Electrician, experienced in power plant operation, maintenance and repairs, desires situation. First class references. Apply Box 901, Electrical News, Toronto. 21-22

An Engineer (28) A.M.I.Mech.E., A.M.I.E.E., desirous of making a change, is open to receive offers from those requiring a first class man to fill a responsible position. Advertiser at present holds post of Mechanical Engineer and Electrical Superintendent to one of the largest Mining and Industrial concerns in Canada, has seen considerable service abroad and would go anywhere at all. Is tactful and energetic with strong initiative and organizing capacity and has highest credentials. Salary according to locality. Apply Box No. 896, Electrical News, Toronto. 20-22

Positions Vacant

WANTED

For Eastern Canada a first class meter man who can handle installation and testing of integrating graphic demand meters in a large company. None but men with experience and executive ability need apply. State age, experience and minimum salary expected. A good opening for an energetic and ambitious man. Apply to P. O. Box 1710, Montreal, Que. 21

Sales Agent Wanted

Large firm manufacturing carbon brushes wants good Canadian distributor who can carry stock in Canada. Apply Box 898, Electrical News, Toronto. 21-22

CITY OF CALGARY

1,000 Kw. Synchronous Motor-Generator and Exciter Set

Tenders will be received by the City Clerk and must be addressed to the City Commissioners and marked "Tender for 1,000 kw. Synchronous Motor-Generator and Exciter Set."

Each tender must be accompanied by the deposit of a marked cheque for the sum of $2,000, which will be returned to the unsuccessful bidder after the awarding of the contract. The successful bidder will be called upon to execute a bond of 25 per cent. of the contract in favor of the City as a guarantee of fulfilment of same.

Tenders must be in the hands of the City Clerk by 12 o'clock noon on Wednesday, November 18th, 1913, and the Commissioners invite all interested parties to be present at the opening of the same.

The lowest or any tender not necessarily accepted.

Specifications can be had upon application at the office of the City Clerk, or at office of Electrical News, Toronto.

J. M. MILLER,
21 City Clerk.

FOR SALE

Canadian Rights for an Electric Device which has been an immense success in the United States. Address Box 887, Electrical News, Toronto. 20tf.

Lighting Schedule for November, 1913

Courtesy of the National Carbon Company, Cleveland

Date.	Light.	Date.	Extinguish.	No. of Hours
Nov. 1	5 30	Nov. 2	5 50	12 20
2	5 30	3	5 50	12 20
3	5 30	4	5 50	12 20
4	5 20	5	5 50	12 30
5	5 20	6	5 50	12 30
6	10 50	7	5 50	7 00
8	00 00	8	5 50	5 50
9	1 00	9	6 00	5 00
10	1 50	10	6 00	4 10
11	2 50	11	6 00	3 10
12	4 00	12	6 00	2 00
13	No Light	13	No Light	
14	No Light	14	No Light	
15	No Light	15	No Light	
16	5 10	16	8 00	2 50
17	5 10	17	9 00	3 50
18	5 10	18	10 10	5 00
19	5 10	19	11 20	6 10
20	5 10	21	0 40	7 30
21	5 10	22	1 50	8 40
22	5 10	23	3 00	9 50
23	5 10	24	4 20	11 10
24	5 10	25	5 30	12 20
25	5 10	26	6 20	13 10
26	5 10	27	6 20	13 10
27	5 00	28	6 20	13 20
28	5 00	29	6 20	13 20
29	5 00	30	6 20	13 20
30	5 00	Dec. 1	6 20	13 20

Total Hours.....236 10



Specialists in
Transmission Lines
Underground
Conduit Systems
Power Plants, Etc.

Dietrich LIMITED

300 Read Bldg., Montreal



HOPE
Tapes and Webbings
for
Electrical Work

Write for Samples and Prices

Hope Webbing Company
Providence, R.I.



WESTON A. C.



Ammeters and Voltmeters, Wattmeters, Synchroscopes, Power Factor Meters and Frequency Meters, constitute a line of Switchboard Alternating Current Indicating Instruments which is unequalled. Send for our Catalogs giving full description of these instruments. They are accurate—durable—dependable—and we stand back of them.

Demonstrations of the operative characteristics of these remarkable instruments may be observed in our New York office, and also in the offices of Selling Representatives in Philadelphia, Chicago, San Francisco and Toronto.

Weston Electrical Instrument Company,

Main Office and Works
NEWARK, N. J.

New York, 114 Liberty Street.
Chicago, 1504 Monadnock Blk.
Boston, 176 Federal Street.
Philadelphia, 342 Mint Arcade.
Birmingham, American Trust Bldg.
Detroit, 618 Union Trust Bldg.
St. Louis, 915 Olive Street.
Denver, 231 15th Street.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Toronto, 76 Bay Street.
Winnipeg, Montreal, Calgary, Vancouver } Northern Electric & Mfg. Co.
London, Audrey House, Ely Place, Holborn.
Paris, 12 Rue St. George
Berlin, Genest St. 5, Schoeneberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Building, Harrison St.



Power Cables

Manufactured by

British Insulated & Helsby Cables, Limited

PAID-UP CAPITAL, $8,500,000.00

HEAD OFFICE—PRESCO, ENG. Works at PRESCOT, HELSBY and LIVERPOOL

Illustration shows a No. 10 B & S, 3 conductor, paper insulated lead covered and double steel tape armored cable for a working pressure of 660 volts. This cable is for laying direct in the ground without any protection whatever and is similar to that supplied to the cities of Saskatoon, Prince Albert, etc., etc.

WRITE FOR ILLUSTRATED CATALOGUE

SOLE CANADIAN REPRESENTATIVES:

Canadian British Insulated Co. LIMITED

MONTREAL, QUE.



STARTING TODAY NOV. 1st

EVERYTHING ELECTRICAL

at Canada's First

ELECTRICAL EXPOSITION

Do not fail to attend this wonderful exhibition and demonstration of the many different electrical appliances and their uses in the home, office and factory and in medicine and surgery, etc.

The management, acting in co-operation with the Montreal Light, Heat and Power Company, have spared no effort to make this event one long to be remembered by the general public.

To be held at

Montreal Arena

Nov. 1st to 8th

Address inquiries,

Manager's Office, 910 New Birks Bldg., Montreal



Don't Waste This Opportunity

The time for the Toronto Electrical Exposition is rapidly drawing nearer and with it approaches the centered activities of the many manufacturers, jobbers and dealers who have already lent their support in making this the banner event of the season.

This exhibition, the first of its kind to be held in Canada, offers the exhibitors an opportunity of advertising and selling to the public together with the central station men and entire electrical trade of Toronto and the Province of Ontario.

Phone or wire your reservation at our expense.

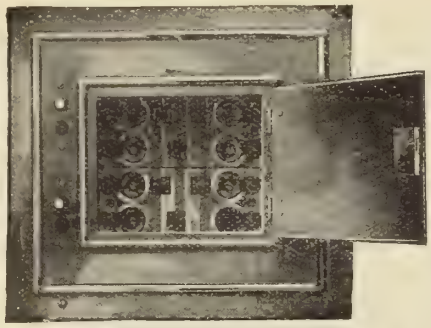
To be held at

Toronto Arena

Nov. 10th to 15th

Address inquiries,

Manager's Office - 62 Temperance St., Toronto



A Radical Departure and Much Needed Improvement

COLUMBIA Push Button Switch Cabinets

Save Cost of Switch Box and Plates.

Push Button instead of knife switches eliminates all danger of accidental contact with live parts, besides assuring longer service, as it is well known that push button switches far outlast knife switches. These new cabinets are much superior to the regular panels and cabinets, they occupy less space and are lower in price. Lock type switches may be substituted for use in public halls, etc. Note the prices. Cabinets only.

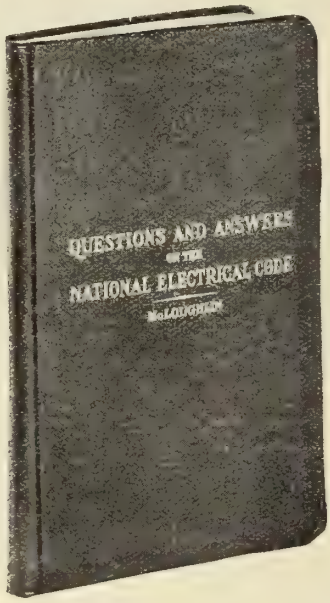
		Prices			
Cat. No.	Circuits	List	Cat. No.	Circuits	List
511	2	$3.50	515	10	$5.50
512	4	4.00	516	12	6.00
513	6	4.50	517	14	6.50
514	8	5.00	518	16	7.00

Write for Bulletin and Discounts

Columbia Metal Box Co.

226-228 E. 144th Street. NEW YORK

You Can Interpret the Code Instantly with McLoughlin's



Questions and Answers

on the

National Electrical Code

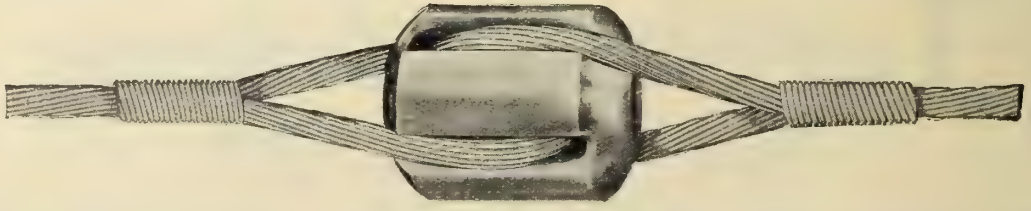
It tells at once the answer to the questions on code requirements.
Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.
Every question is carefully indexed so that you can locate the fact you are after instantly.
Contents—There are nine main divisions: Generators, Transformers, Outside Works, Signaling Systems, Lighting, Inside Works, Electric Railway Systems, Marine Work.
Tables—Section 9 has 32 tables. They give in convenient form for ready reference: Capacities of wires; Wire requirements for all classes of work; Insulation Tests; Requirements for Conduit Wires; Flexible Cords; Fixture Wires; Theatre Cables; Elevator Cables, etc., etc.
The latest rules for Resuscitation are included.

232 pages, pocket size, flexible binding $1.00 net, prepaid.

For Sale by

Electrical News, - 220 King Street West, Toronto

WHITE'S IMPROVED PORCELAIN STRAIN INSULATOR



Not affected by climatic changes. Is sure money saver—and gives perfect satisfaction wherever used.

Write for Sample and Bulletin **T. C. WHITE COMPANY, 1124 Pine St., St. Louis, Mo.**



If You Are Interested

in prompt shipments, at economical prices, of high grade

Bare Copper Wire
Weatherproof Wire
Rubber Insulated Wire

we solicit your inquiries.

We have large, fresh stocks of these materials and can make immediate shipment of orders, large or small.

Write to-day to our nearest office for quotations.

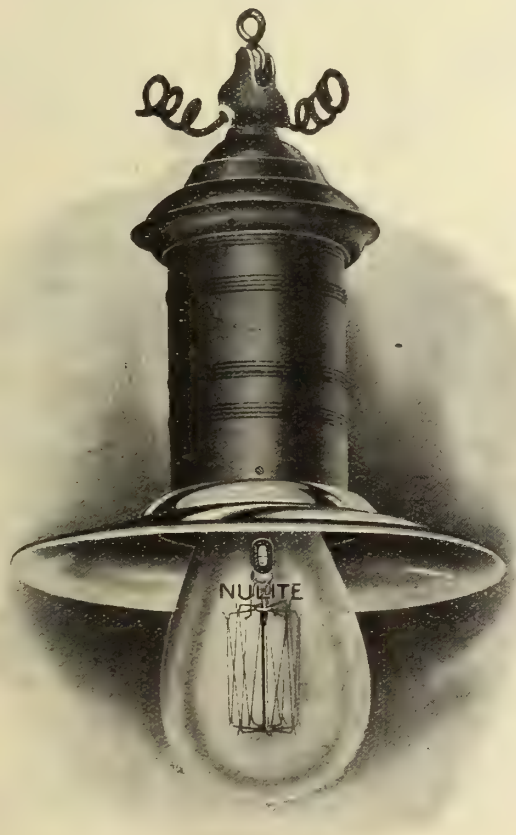
Standard Underground Cable Company of Canada, Limited

Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for a l services, also Cable Terminals, Junction Boxes, etc.





Nulite Arc Fixture

For Factory, Mill, Warehouse

BANNER TRADE MARK

The broad distribution of light from this fixture is intensive in character. Puts the light where you want it without any waste. Suitable for inside or outside use. Its weatherproof. Has a highly polished reflector 13¼ inches in diameter.

The Ontario Lantern & Lamp Co., Limited

Hamilton - - Ontario

The Electrical Engineering Co. of Toronto

130 Wellington Street West

ARE YOU CHANGING YOUR SERVICE FROM 60 TO 25 CYCLE, IF SO, HOW ABOUT THAT OLD MOTOR?

Better send it to the above address and have us re-design and re-wind it for to suit your new current; and remember, all our re-winds, re-designs and alterations are carried out under expert designers and engineers, where the best of material and facilities are to be had thus ensuring you of every satisfaction.

Direct current motors and generators re-designed for any pressure.

Special transformers and choking coils made to order.

EXPERT REPAIR MEN TO BE HAD DAY OR NIGHT BY PHONING

Day Adelaide 3183 **Night College 2235**

The

Lachute Shuttle Co.

Limited

Lachute Mills, Que.

Manufacturers of

CROSS ARMS made from straight grained Douglas Fir, Long Leaf Yellow Pine and Red or Norway Pine.

The largest manufacturer of Cross Arms in the East.

INSULATOR TOP PINS made from Birch, Elm, Locust and Oak.

BRACKETS made from Birch and Oak.

POLE STEPS made from Oak.

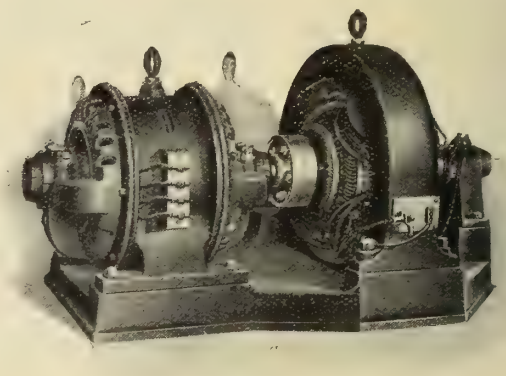
STRAIN PINS made from Second growth Hickory.

SPECIAL PINS for HIGH VOLTAGE TRANSMISSION made from Locust and Oak, all kinds and sizes.

All products boiled in Parafine and Stearine or Creosoted if wanted.

CORRESPONDENCE SOLICITED

Special Machines



When in need of any special electrical apparatus or repairs to defective motors or generators, write us. We are fully equipped.

Toronto & Hamilton Electric Company

HAMILTON



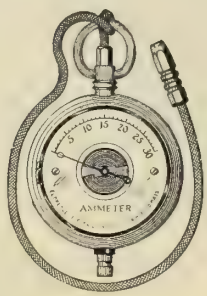
DAUM Fuses

are imitated but never equalled. In our Latest Types we abolish threads, screws, rivets and clamps on Fibre Tube —instead are using a metal piece with prongs. It is also adapted to all contacts. There is no more stripping or burning of threads—especially the Type "B" Fuses—the fibre can expand or contract and you always have a perfect electrical contact as the fusible element does not depend upon the fibre for making a contact, as the cut shows. Samples for the asking. May we send you samples for tests? Insist on getting the original Fuses –

Sole Manufacturers **DAUM**

A. F. DAUM COMPANY, PITTSBURGH, PA.

Pocket Battery Ammeters



Voltmeters and Volt-ammeters, Small Switch-board Instruments, Lamp Testers.

Accurate, Durable.

Eldridge Electric Mfg. Co.

97 Post Office Square
SPRINGFIELD, MASS., U.S.A.

Consider those two most important factors "SERVICE" and "MAINTENANCE"

when you are purchasing telephones. Realize that the financial success of your plant is dependent upon your ability to please your subscribers by making your service speedy and reliable and in cutting down every dollar of expense possible.

Put your money into Kellogg telephones and make a safe investment. There will be a big demand for your service. Every dollar spent will bring you, in return, service of the highest order. Service that has made thousand line exchanges from a small beginning of a few hundred lines.

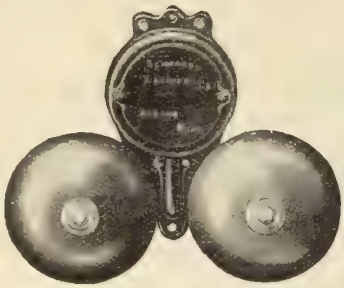
There are ten thousand or more complete Kellogg plants in the United States which stand as evidence of this fact. Give us a trial order. Give us an opportunity to demonstrate the superior talking quality of our telephones.

Send for our bulletins which, aside from description of apparatus, contain valuable information on modern telephone practice. Kindly mention this magazine when writing.

KELLOGG SWITCHBOARD & SUPPLY COMPANY
CHICAGO, ILL.

CANADIAN SALES OFFICES:

REGINA—DEERING ELECTRIC LIMITED, WINNIPEG—HOUSTON & COMPANY, LIMITED



We Have a Bell For Every Purpose

There can be only **one best** and that is the **Schwarze. No. 12 Common Magneto Extension** for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire **is all active.** Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

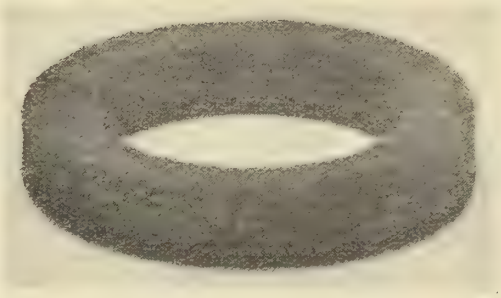
No. 13, same as No. 12, except larger and **very much louder**, and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof. Write for catalogue. **All resistances.**

Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents

Booth



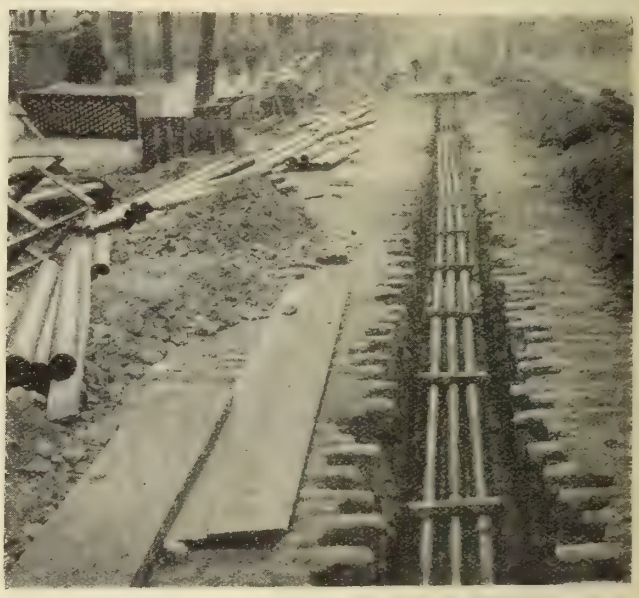
Saves time and money for anyone wanting Felt Washers, Packings, Gaskets, or mechanical felt goods of any description.
All sizes made in Canada and shipped within 24 hours.
Send us your orders.
Try Booth out on a basis of quality, time and cost.

If it's made of felt, ask Booth

The Booth Felt Co., Limited

GANANOQUE, ONT.

Branch of N. E. BOOTH, Brooklyn, N.Y.



Manitoba Gov. Installation at Winnipeg.

Long Lengths 7 ft. Thick Walls 3/8 inch. Long Joints 5/8 inch,

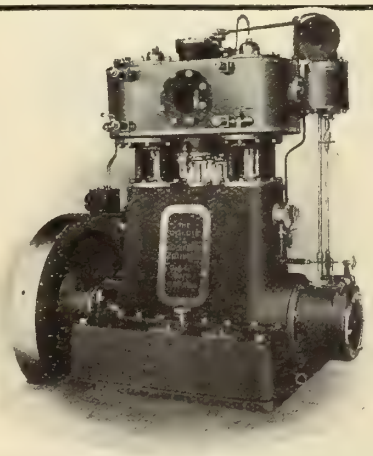
We will absolutely guarantee a puncture strength of 50,000 volts and an absorption of moisture for 100 hours of less than ¼ of 1%.

Comparison of above figures with other types of Fiber Conduit will show the superiority of our product.

American Conduit Co.

East Chicago, Ind., U. S. A. 140 Nassau St., N. Y. City

Distributors for Canada:
The Northern Electric & Mfg. Company, Limited, Montreal, Halifax, Toronto, Winnipeg, Regina, Calgary, Edmonton, Vancouver.



Vertical, Forced Lubrication

Quick Revolution Engines

With Combined Throttle and Expansion Governor

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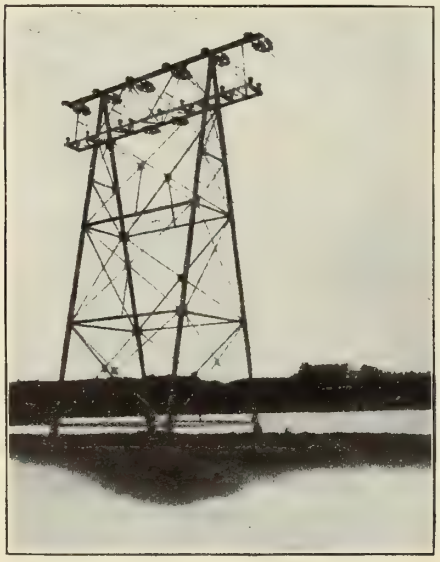
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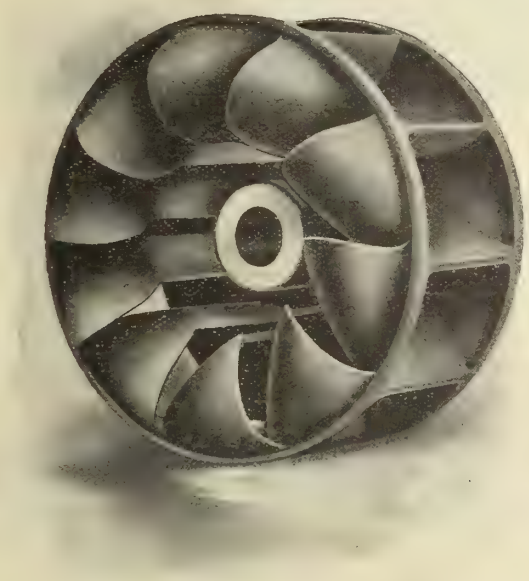
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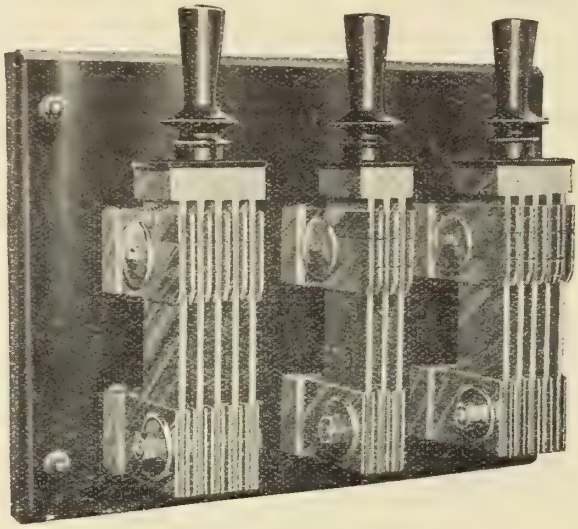
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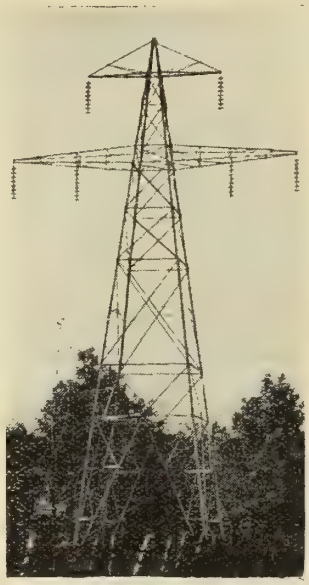
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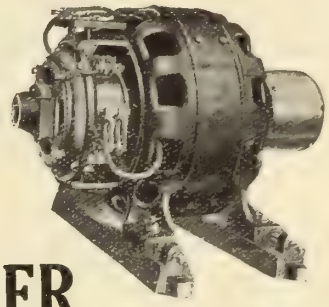
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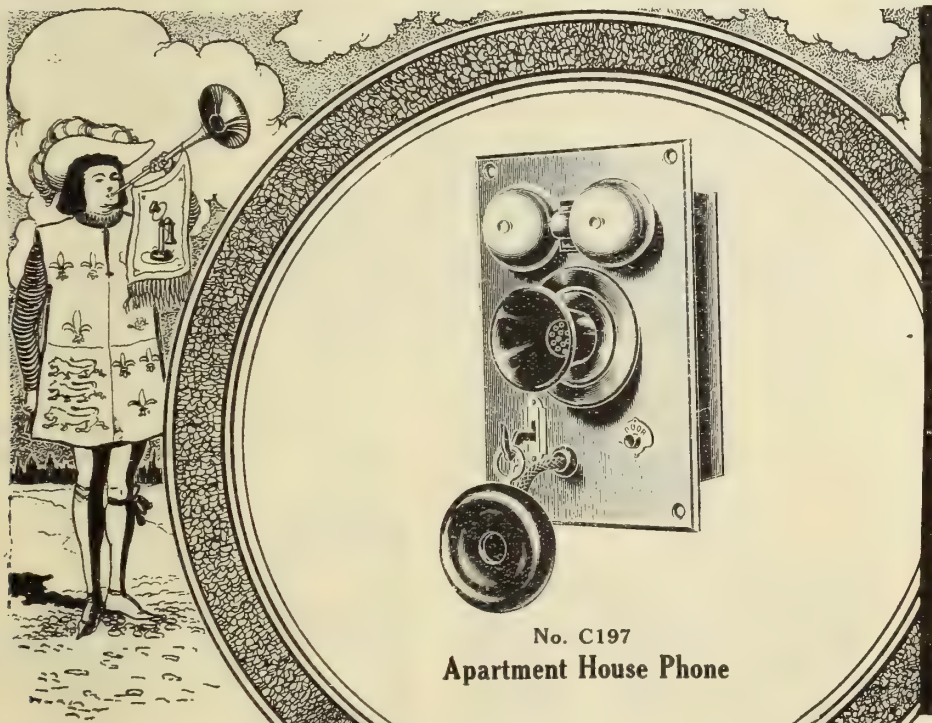
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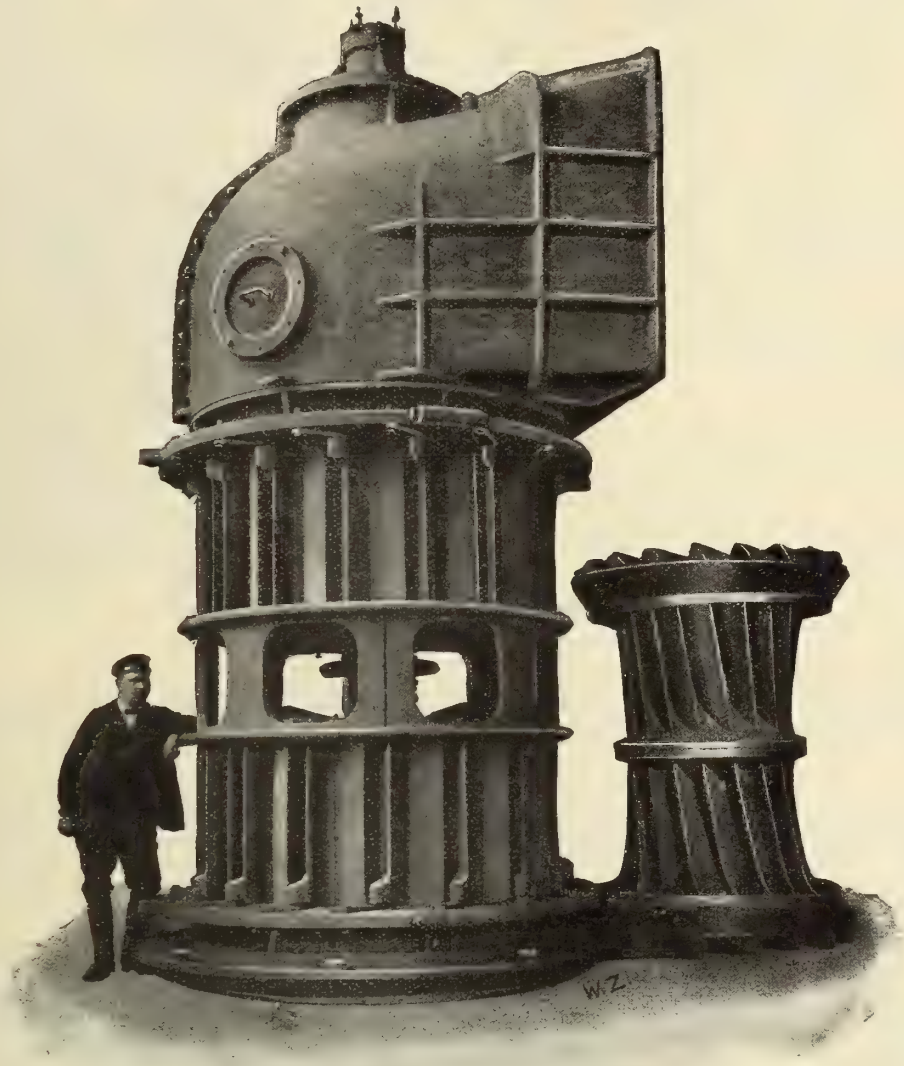
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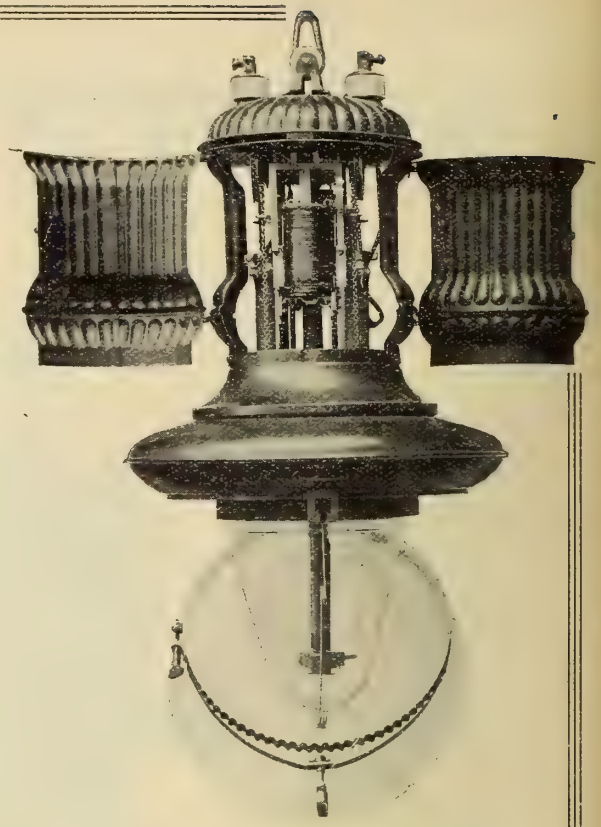
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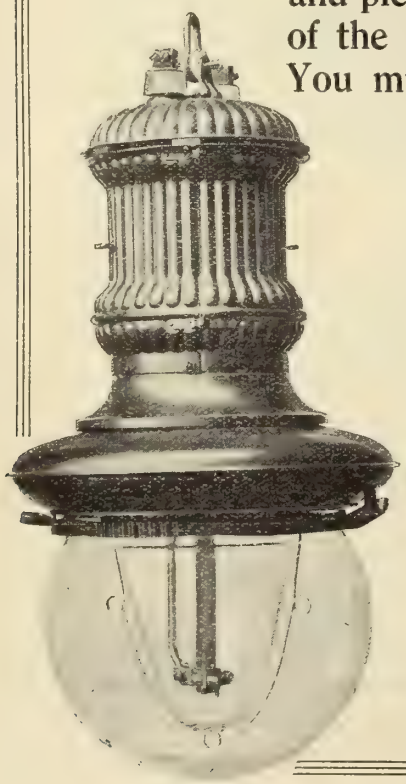
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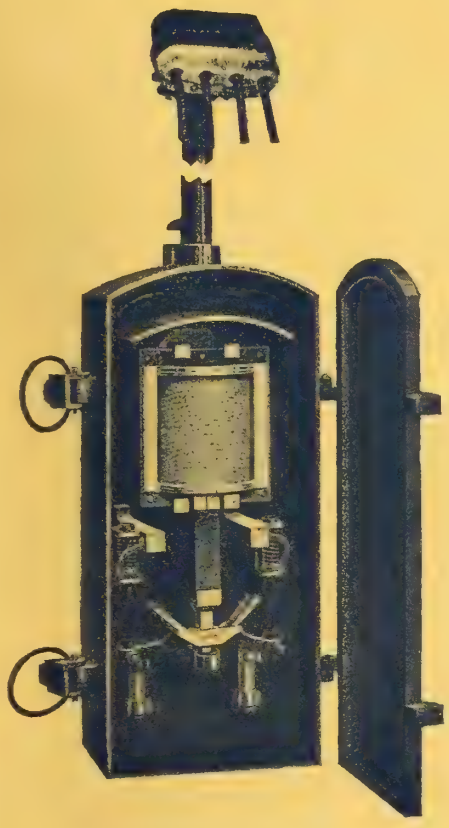
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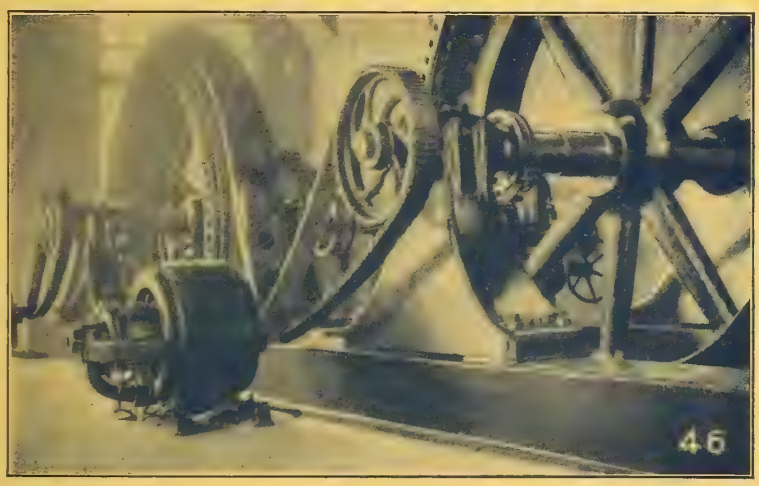
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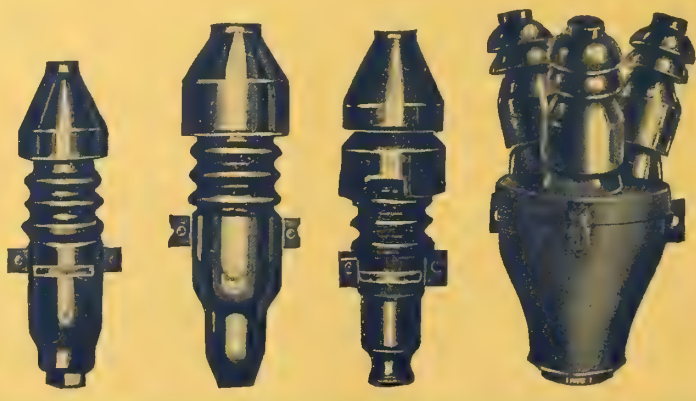
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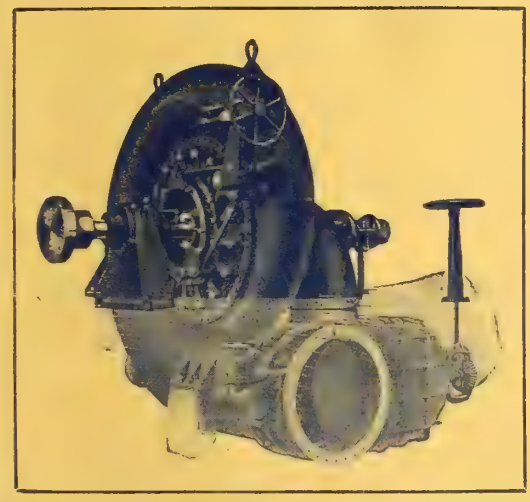
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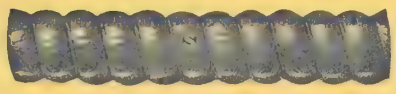
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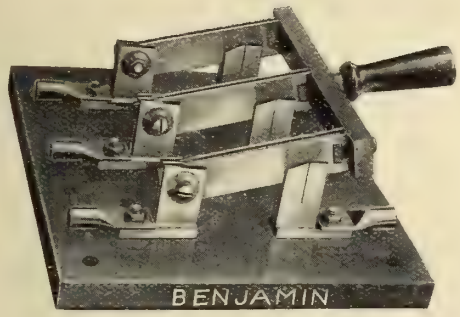
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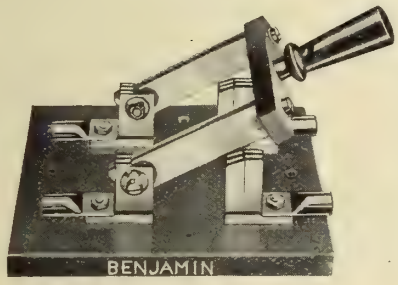




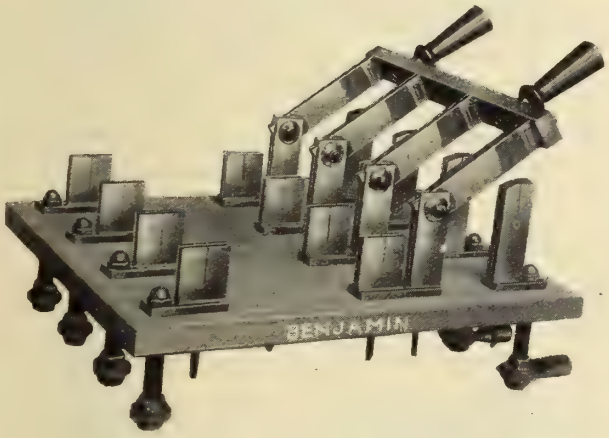
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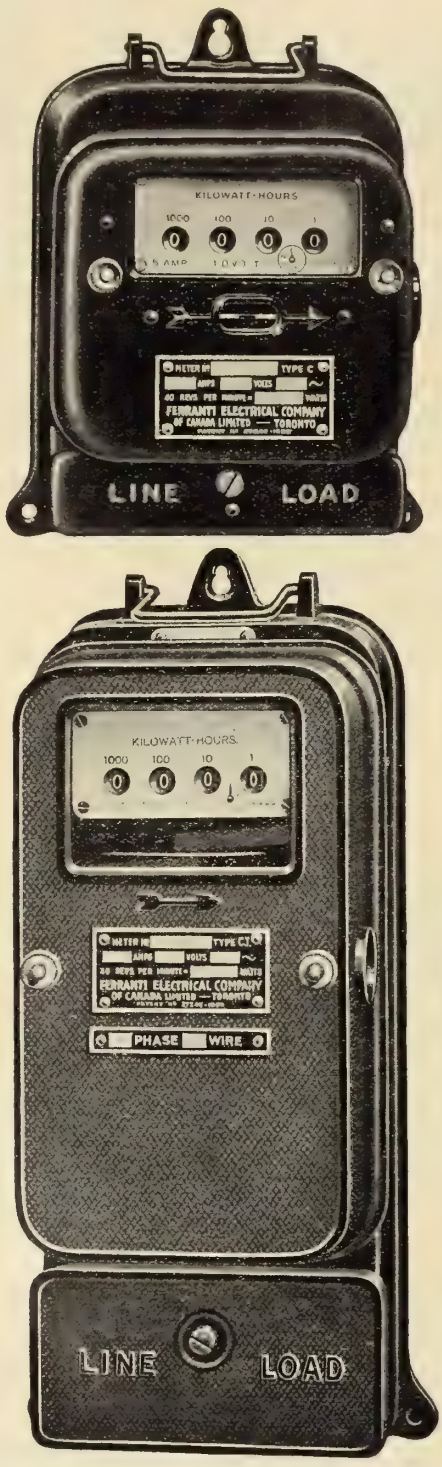
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of Canada, Limited
11-17 Charlotte St., TORONTO, CANADA



Ferranti Meters

are made to suit your service.

Top or Bottom Connections

Clock or Cyclometer Dials

Ferranti Improved Type "C" Meter, Single or Polyphase

These meters are guaranteed against mechanical and electrical defects for a term of three years and satisfy the most exacting customers under all conditions.

The Ferranti Meter has distinct improvements over all other makes.

Our prices are right. Send us your enquiries.

Ferranti Meters are assembled, tested and stocked at our warehouses at Toronto and Winnipeg.

Prompt shipments for standard meters can be made at all times.

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherburne St., TORONTO 56 Albert St. WINNIPEG

Continuous Track Circuit — the basis of the only always-safe Signal System

as applied in the light of all the experience, skill and knowledge which have developed the

G. R. S. Automatic Block System

Continuous Track Circuit Signaling is the only kind which gives the proper signal indication in such a manner that every foot of the way is protected not only against unauthorized train movements, but also against defects in the track, such as broken or removed rails, also open switches or [illegible] spans, cars fouling the main [illegible] etc.

It is the only system yet devised that makes the train itself master of the situation wherever it may be in the block and for the entire time any portion of it continues to occupy that block.

G R. S. Automatic Block Signals are based on the only system that makes complete protection possible.

Literature upon request.



Safety First

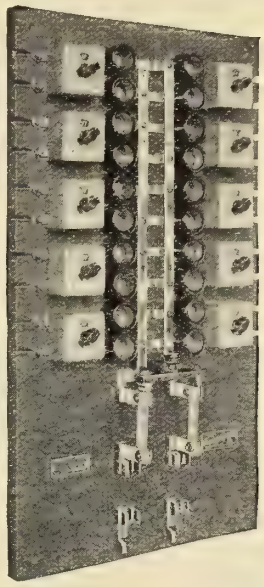
GENERAL RAILWAY SIGNAL COMPANY
OF CANADA, Limited

Office and Works
Lachine, Quebec.

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PANEL BOARDS
AND
STEEL CABINETS



Meter
Control Panels
and
Switchboards
are built in
Standard and Special Designs
for both
A.C. and D.C. Light
and
Power Distribution.

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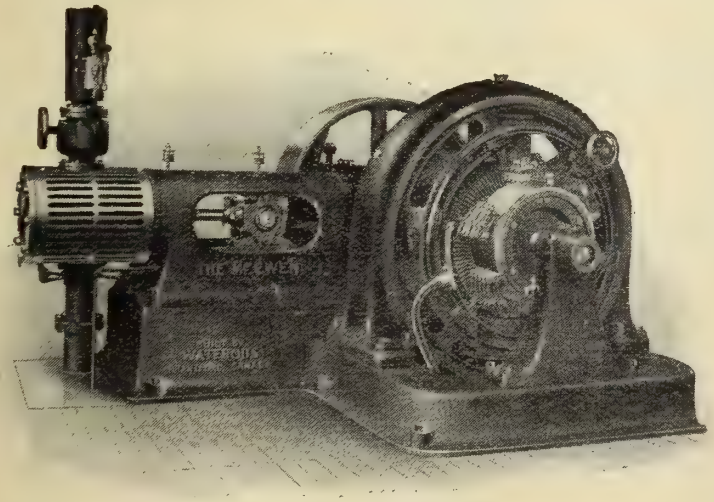
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Continuous Power For Industrial Use

A McEwen Engine in your Power Plant is your best guarantee against shut-downs and large repair bills. Your plant is not at the mercy of the elements—there are no tie-ups because "something has gone wrong on the transmission line." McEwen Engines are sold on a basis of quality—of economical initial performance—that is maintained year after year.

McEWEN ENGINES



Improve with use.

A simple and sturdy design—steam valves that are absolutely tight—a governor that permits of the closest regulation—an oiling system that gives perfect lubrication —These are some of the features that have placed McEwen Engines in hundreds of steam plants in Canada.

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The Waterous Engine Works
Company, Limited
BRANTFORD - CANADA

GMUR & COMPANY, LIMITED

Aarau, Switzerland

CAPITAL $ 200,000

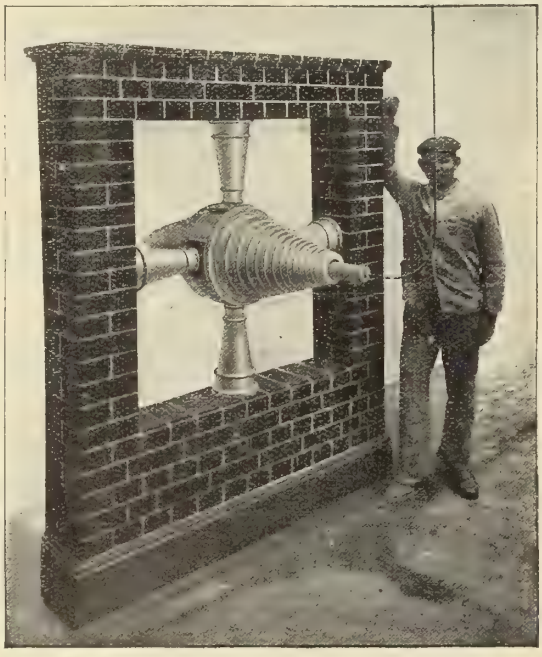
Carbon Filaments in all Shapes and Sizes **Flexible Metal Filament "Uranit"**

Drawn Light Wire "Uranit" **Supports** Carbon, "Uranit" Alloy Molybdenum, Molybdenum Alloy

Tungsten-Molybdenum Wire in all Sizes

LARGEST SPECIAL FACTORY FOR LAMP FILAMENTS

Porzellanfabrik Hermsdorf



Sachsen-Altenburg, Germany

Wall Duct for the High Tension Transmission Station of the

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110,000 Volts

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Watson Jack & Company

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"EUREKA" ELECTRIC CLEANER

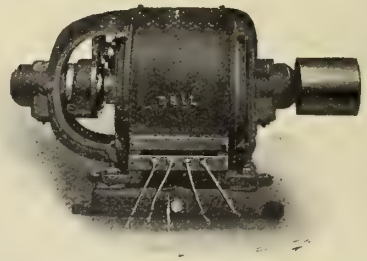


Thoroughly reliable and absolutely guaranteed. Sold at a moderate price with a good profit to the dealer.

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"BELL" High Efficiency Single Phase Motors



Meet All Requirements

Large stock carried throughout the country for immediate shipment.

Attractive Prices consistent with QUALITY

Our bulletin No. 138 which fully describes them will be sent to all interested.

Bell Electric Motor Co., 30 Church Street, NEW YORK CITY

LICENSED. Factory, GARWOOD, N. J.

Canadian Representative:

The Masco Company, Ltd., 205 Yonge St., Toronto, Can.

Stock carried in Canada

A SILCOR TUMBLE

Beats The Balls Buffer, Sand Blast

And all other devices for polishing

THE HIGHEST AND CHEAPEST LUSTRE AND IN EVERY TINY CORNER

TENDER WITH THE MOST DELICATE BUT CUTS THE HARDEST STEEL BRASS, NICKEL, CAST IRON, GERMAN SILVER, STEEL—ANY METAL

Small Plants—Five dollars' worth of "SILCOR" and an improvised barrel will save most all that hand labor.
Large Plants—Dispense with hand labor and roll both tiny and huge pieces in "SILCOR."
Holding a piece to a buffer is as illogical as turning the buffer by hand. Let the Power roll it in "SILCOR." "SILCOR" will find every spot.
It costs so little to polish by tumbling with "SILCOR" that no piece ought to leave your plant unpolished.
Send 10c and parcel postage for sample pound and shake some of your pieces in a tin can. Then send for a barrel load.

Corundum Products Company

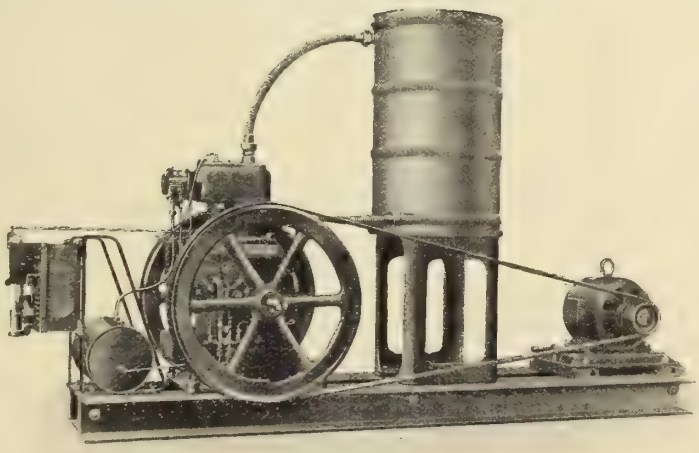
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The LISTER-BRUSTON

AUTOMATIC ELECTRIC LIGHTING PLANT

Are you interested in the lighting of

Country Houses
Hotels
Summer Homes
Churches
Factories
Small Towns
Villages?



This is the easiest and cheapest plant to install and wins you the confidence of your customer.

Agents Wanted

Specifications and tenders for complete installations submitted on application.

THIS PLANT generates electricity automatically and does away with the necessity of large expensive storage batteries. With the exception of keeping it clean, lubricating and filling the gasoline supply tank, no attention is required. In addition to these advantages the first cost is low, space required small and no foundations are necessary. It is delivered practically ready for connecting up to the house wiring, and can consequently be used within a few hours of being unpacked.

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GALVADUCT

LORICATED

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

The largest buildings, the finest residences, the biggest factories. All such buildings are equipped with the world's best conduits— "Galvaduct" and "Loricated."

"LORICATED"

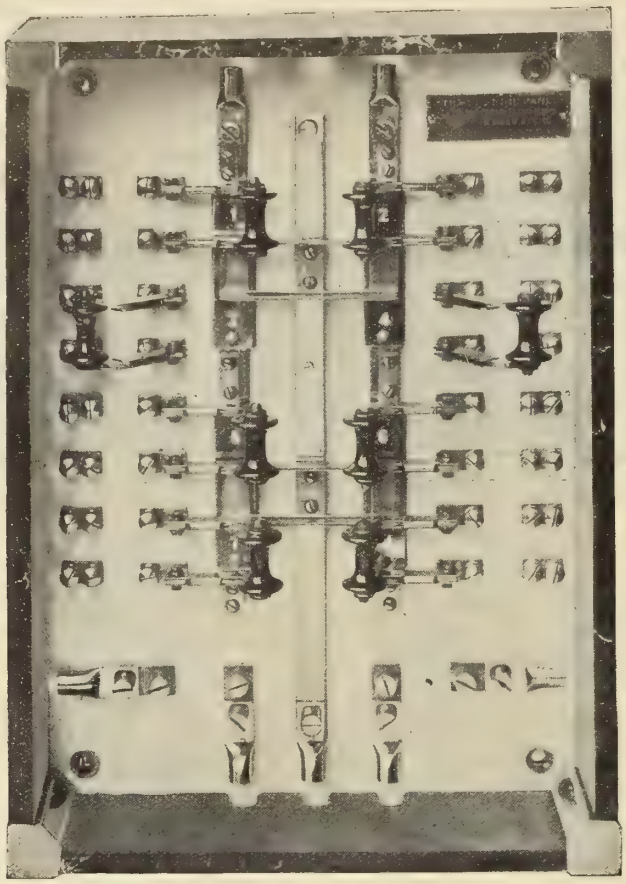
A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

Your jobber will supply you.

Conduits Company Limited

Toronto - Montreal



KRANTZ

Safety and efficiency characterizes all designs of

KRANTZ

Switch Boards and Panel Boards

They are used in many of the largest institutions, office and Government buildings throughout Canada and the United States.

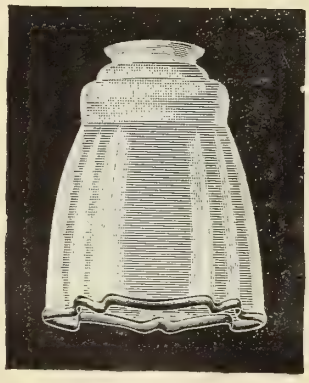
See that your specifications call for "Krantz." They are recognized by leading engineers as a standard and are passed by the Underwriters' Association.

GET OUR QUOTATIONS

The Canadian Krantz Elec. Mfg. Co., Ltd.

249 Victoria Street

TORONTO ONTARIO

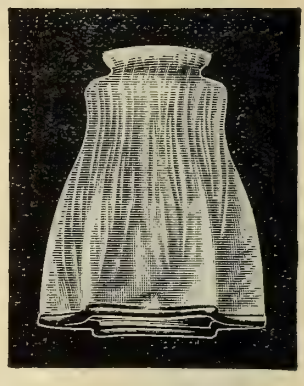


We Stock

Glassware

suitable for any kind of service

Residential or Commercial



We carry a full line of each of the following makes :

Max Kray & Co. This line comprises over 100 different patterns in residential shades.
Jefferson Glass Company.
Holophane Company.
National X-Ray Reflector Company.
MacBeth Evans Glass Company.

Mainer Electric Company, Limited

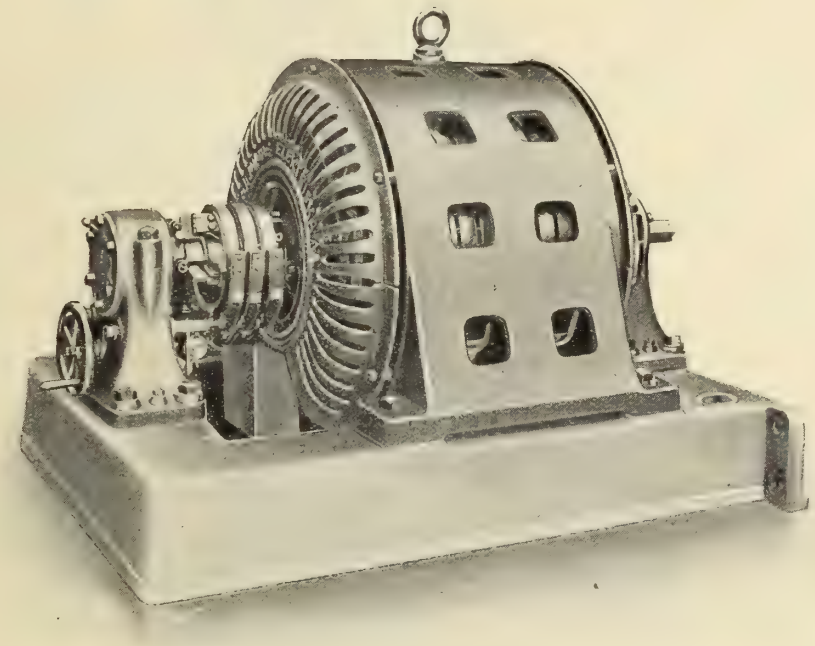
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Prompt Shipments *New Goods* *Right Prices*

Swedish Electrical Machinery

Noted for

Efficiency and Workmanship



400 H. P., 3 Phase, 60 Cycle, 2200 Volts, 3600 R.P.M., Slipring Type of Induction Motor for direct connection to a turbine pump.

We solicit your specifications for Electrical Equipment

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LIMITED

Canadian Dealers for

The Amalgamated Electric Company of Sweden

Head Office:
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'Elementary Telegraphy," by Pendry. Published in 1910 by Whittaker & Company. Price $1.00.

'Practical Testing of Electric Machines," by Oulton & Wilson. Published in 1909 by Whittaker & Company. Price 75c.

"Wireless Telegraphy Construction for Amateurs," by Morgan. Published in 1910 by D. Van Nostrand & Company. Price $1.50.

'Direct and Alternating Current Testing," by Bedell. Published in 1909 by D. Van Nostrand & Company. Price $2.00.

"A Laboratory Manual of Alternating Currents," by John H. Morecroft, E.E. Published in 1912 by Renouf Publishing Company. Price $2.00.

'Modern Electrical Construction," by Henry C. Horstmann and Victor H. Tousley. Published in 1911 by Frederick J. Drake & Co. Price $1.00.

"Electricians' Operating and Testing Manual," by Henry C. Horstmann and Victor H. Tousley. Published in 1910 by Frederick J. Drake & Company. Price $1.50.

"Telephony," by Samuel G. McMeen and Kempster B. Miller. Published in 1912 by the American School of Correspondence. Price $3.00.

"Elevators, Hydraulic & Electric," by Calvin F. Swingle. Published in 1910 by Frederick J. Drake & Company. Price $1.00.

"Practical Mathematics for the Engineer and Electrician," by Elmer E. Burns and Joseph G. Branch. Published in 1912 by the Joseph G. Branch Publishing Company. Price $1.00.

"The Electric Motor and Its Practical Operation," by Elmer E. Burns. Published in 1912 by Joseph G. Branch Publishing Company. Price $1.00.

'Alternating Currents Simplified," by Elmer E. Burns. Published in 1912 by the Joseph G. Branch Publishing Company. Price $1.00.

"Wireless Telegraphy and Telephony Simply Explained," by Alfred P. Morgan. Published in 1913 by the Norman W. Henley Publishing Company. Price $1.00.

"Experimental Wireless Stations," by Philip E. Edelman. Published in 1912 by Philip E. Edelman. Price $2.00.

"Electric Wiring & Lighting," by Charles E. Knox. E.E. Published in 1913 by the American School of Correspondence. Price $1.50.

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"Conversations in Electricity," by Branch. Published in 1908 by the Branch Publishing Company. Price $2.00.

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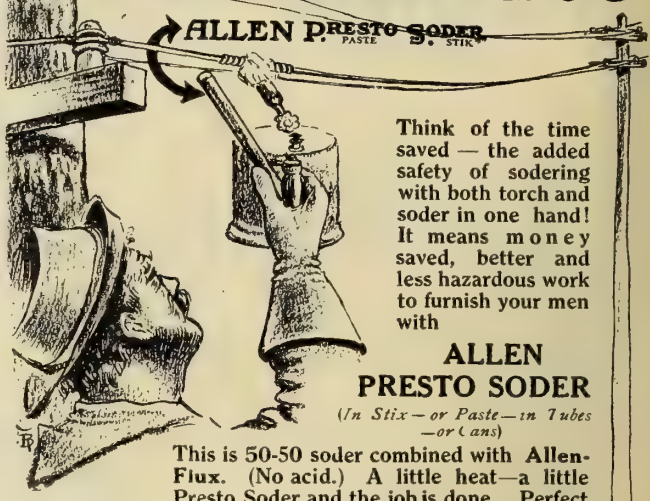
Order at once if interested.

Book Department

Electrical News

220 King Street West - Toronto, Ontario

One Hand Free



Think of the time saved — the added safety of sodering with both torch and soder in one hand! It means money saved, better and less hazardous work to furnish your men with

ALLEN PRESTO SODER

(In Stix — or Paste — in Tubes — or Cans)

This is 50-50 soder combined with Allen-Flux. (No acid.) A little heat—a little Presto Soder and the job is done. Perfect joint — no waste of material—no corrosion—permanent. Used by the large telephone and power companies in this and foreign countries. Proven by test to give joints of greatest conductivity.

You owe it to yourself and your company to give it a fair trial. Send 15c. and your dealer's name for sample to-day.

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4546 N. Lincoln St. Chicago, U. S. A.

Makers of Allen-Flux—(no acid)—Stix—Paste—Salts—Liquid

Houston & Co., Western Can. Agts., 557 Henry Ave., Winnipeg, Canada

Goods manufactured by

The Canada Metal Co., Limited

Have a Reputation for Quality

IMPERIAL SOLDERING PASTE

Absolutely the finest soldering paste on the market.

IN TINS
2 oz.
4 oz.



IN TINS
8 oz.
16 oz.

A Sample Order will convince you that we have reason to be proud of the goods we manufacture.

Manufactured by

The CANADA METAL CO., LIMITED

TORONTO

Branch Factories: MONTREAL and WINNIPEG

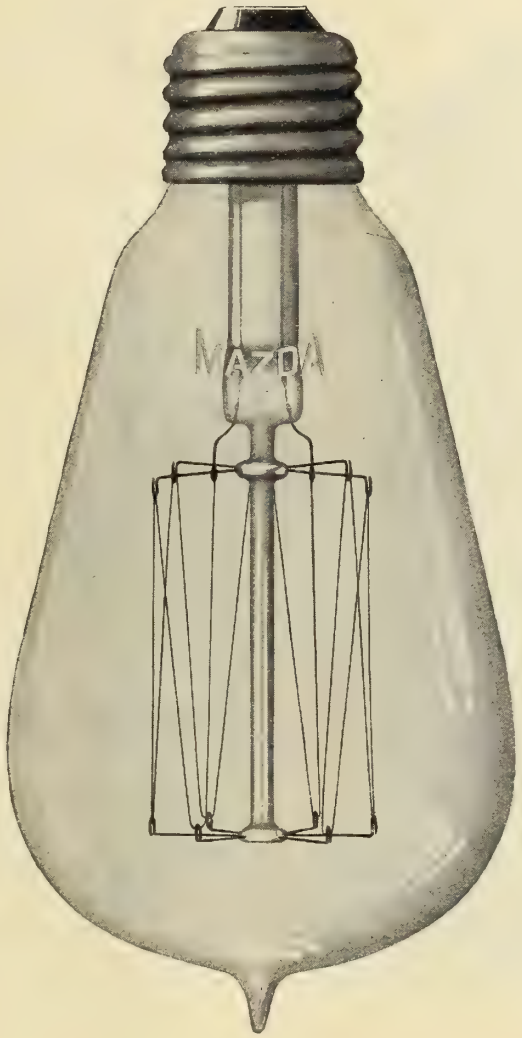
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MAZDA

Drawn Wire Tungsten Lamps

Highest Quality

Long Life



Greatest Efficiency

Prompt Delivery

Canadian Sunbeam Lamp Co.

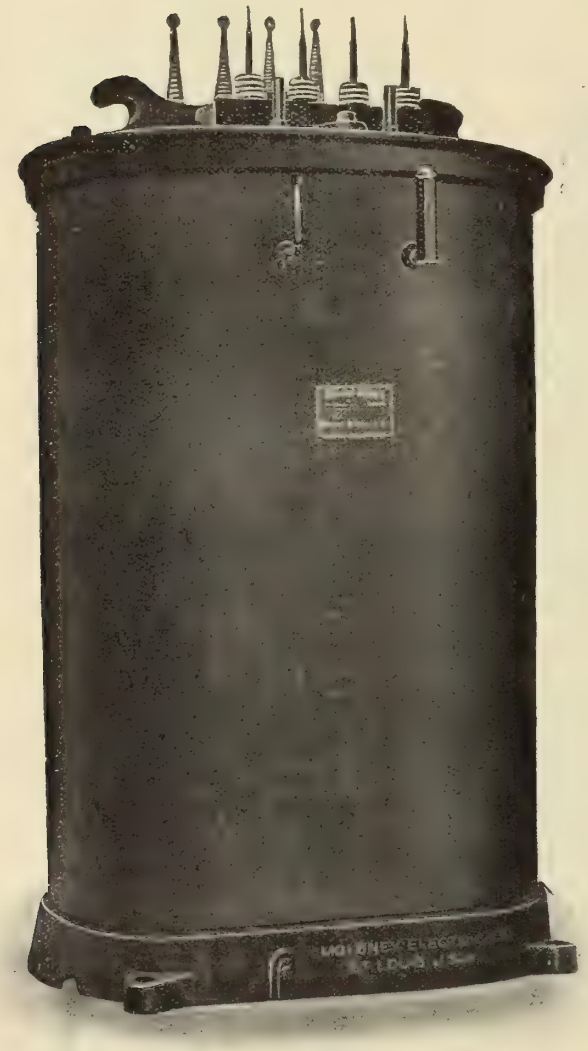
Limited

Main Office and Factory: TORONTO

BRANCH WAREHOUSES:

MONTREAL WINNIPEG CALGARY VANCOUVER

The Best In 1897 Moloney Efficiency



A PERFECT transformer should take your current at one voltage and deliver it (100%) another voltage. No transformer made will do this as the core and copper losses consume some energy. The special core type construction of Moloney High Efficiency transformers and the nonageing Silicon Alloy Steel used in their manufacture reduces core loss to a minimum. Carrying capacity of the copper reduces loss.

Moloney Transformers will save 20% of the cost of other good transformers, and in five years the cost of a new transformer.

Our Catalogue contains much valuable information

The Best In 1913

Canadian Moloney Electric Company, Limited

WINDSOR, ONTARIO

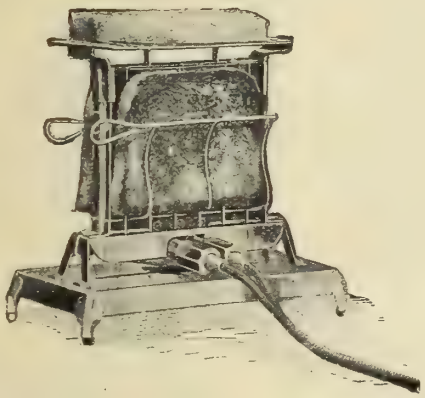
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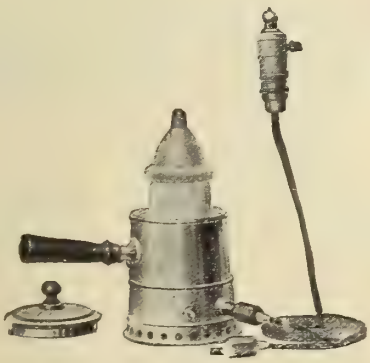
825 Vancouver Block, Vancouver B. C., Canada
901 New Electric Railway Chambers, Winnipeg, Man., Canada
501 C. P. R. Building, Toronto, Ont., Canada

Complete stocks carried at Windsor, Winnipeg and Vancouver









Prompt Shipments Are Guaranteed

You may require some of these articles in a hurry during the Xmas season.

We are prepared to fill your orders promptly.

A complete stock of Household Electrical Appliances is kept at each of our houses.

Make sure now that you are prepared for the Xmas trade. Look over your stock to-day.

THE Northern Electric AND MANUFACTURING CO. LIMITED

Montreal Halifax Toronto Winnipeg Regina Calgary Edmonton Vancouver Victoria

An Electrical Xmas This Year





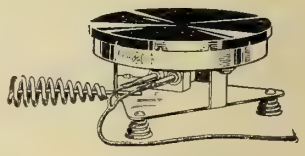
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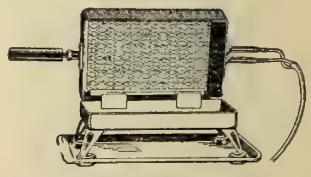
Chafing Dish



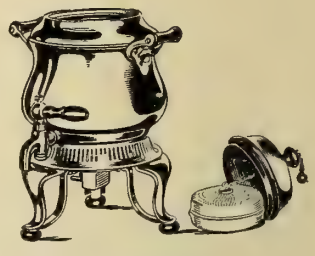
Coffee Urn



Disk Stove



Radiant Grill



Tea Samovar

ELECTRIC GIFTS are useful gifts, each does some one thing better than it can be done any other way, whether it is to toast bread, make coffee, or do the family ironing.

Suitable electrotypes for newspaper advertising will be gladly furnished you free of charge.

Commence the Shop Early campaign by placing your order for C.G.E. heating and cooking appliances.

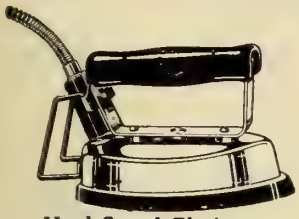
CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

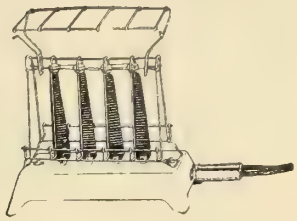
CHRISTMAS SUGGESTIONS



Heel Stand Flatiron

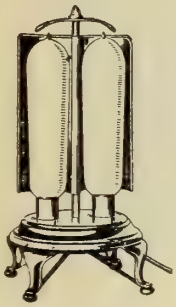


Two Disk Hot Plate



Radiant Toaster





Twin Glower
Radiator



Heating Pad



Baby Milk Warmer



Coffee Pot

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO. District Sales Offices: Montreal, Halifax, Ottawa, Fort William, Winnipeg, Calgary, Vancouver, Victoria, Cobalt, Regina, Edmonton, Porcupine, Saskatoon, Nelson, Prince Rupert.

Protection from Lightning Troubles

(MOSCIKI SYSTEM)

The following list of users of the Mosciki System of Lightning Protection speaks for itself:

Victoria Falls and Transval Power Co.
Shanghai Municipality.
Melbourne Electric Supply Co.
Cleveland and Durham Power Co.
St. John Del. Key Co. Brazil.
Societa Dergano.
Sociedad Espanola, Madrid
Societa Electrica Suburbana, Milan. &c.

Lightning, if unchecked, will break the windings of your apparatus, blow out your fuses and break down your transformers.

In short, lack of adequate and capable lightning protection may mean to you serious loss of time, money, and perhaps lives.

A host of so-called lightning arresters are on the market, but 99 per cent. of them are valueless because the principle on which they are constructed is wrong.

High frequency—not high voltage— is the cause of the damage done by lightning.

Most protective systems work on the principle that high voltage is the cause of the damage. This is incorrect, hence their uselessness.

A lightning protection apparatus to be of any use **must offer a clear path to earth for high frequency currents independent of voltage.**

The MOSCIKI System of Lightning Protection fulfils this condition absolutely — its principle is correct—its design the best and its guarantee absolute. Write us for fuller particulars.

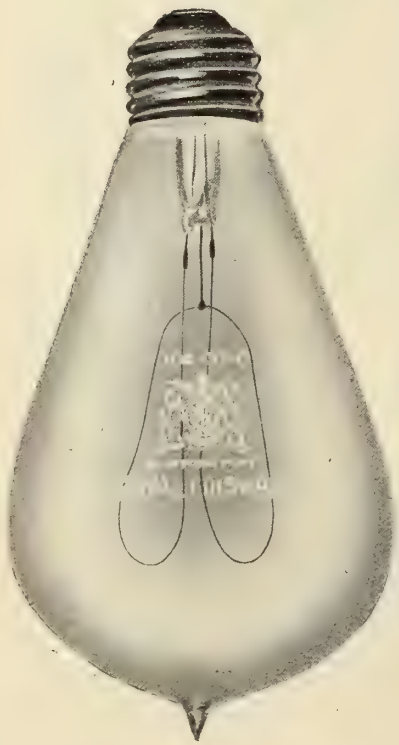
Mosciki Lightning Arrester



Exclusive Canadian Agents:

CHAPMAN & WALKER, ELECTRICAL ENGINEERS AND CONTRACTORS

116-118 Richmond Street W., TORONTO



No. 21 Bulb, 50 C. P.

We are sole Canadian agents for

"ROYAL EDISWAN"

CARBON FILAMENT LAMPS

In the manufacture of the "Royal Ediswan" Carbon Lamp, the makers have spared no effort to perfect a product of superior quality and maximum efficiency.

Those among your customers who prefer the carbon filament lamp will find the "Royal Ediswan" a satisfaction which comes only from a high-grade product.

Made in standard American bulbs, (also fancy bulbs) and built to standard specifications.

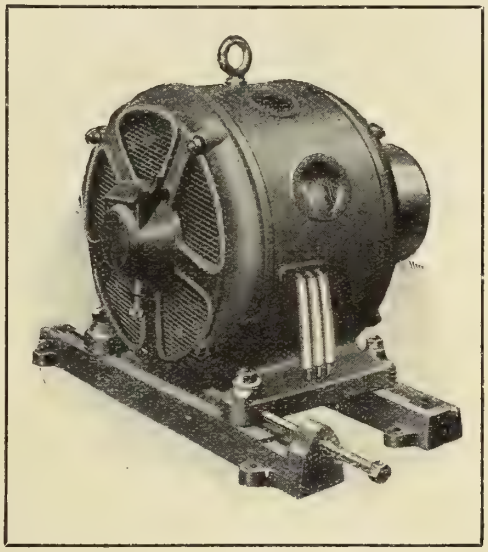
We are prepared to make prompt shipments on all orders—large or small.

Chapman & Walker, Limited

TORONTO 118-20 Richmond St. W., ONTARIO

MONTREAL WINNIPEG VANCOUVER

WE CARRY IN STOCK



Squirrel Cage Motors up to 45 H. P.

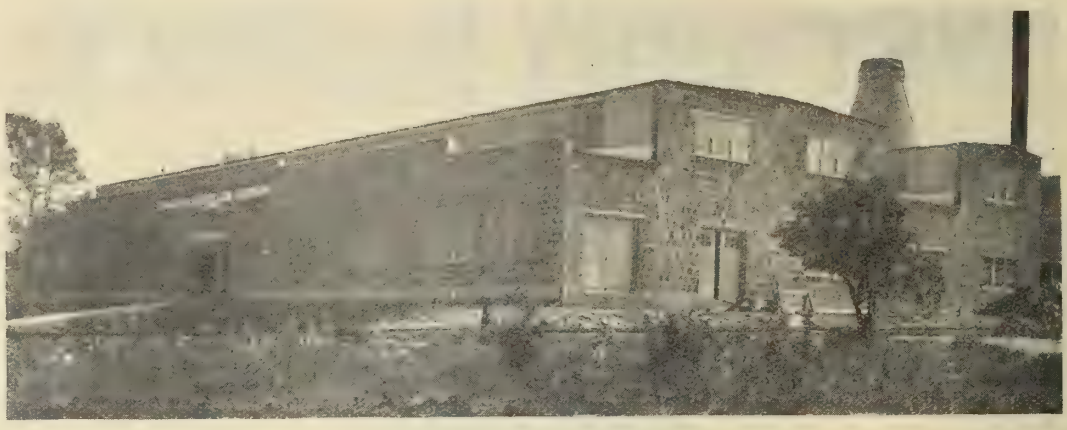
We can supply Electrical Machinery from 1/8 to 6,000 H. P.

CANADIAN BRITISH ENGINEERING COMPANY, LIMITED

324 Smith Street, WINNIPEG

The Canadian Porcelain Company, Limited

HAMILTON, - ONTARIO



Cut shows new plant recently completed and now in operation.

We wish to announce our readiness to tender on your insulator requirements.

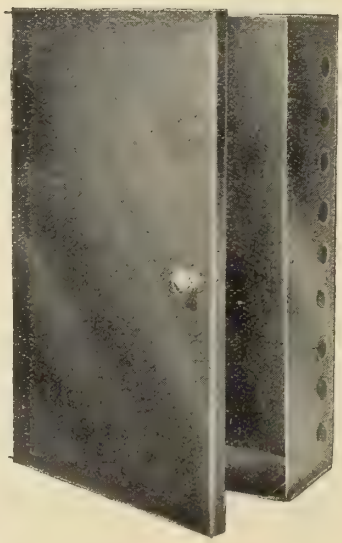
Our plant is modern in every respect embodying the best European and American practice in arrangement and methods.

Our plant is in charge of experienced insulator specialists.

"DEVOE" One Piece Formed Boxes

SAY: Do you know that "DEVOE" one Piece formed boxes are made in Canada, built of the best "ENGLISH" steel and formed from one piece of metal. Covers are bent on all four sides making them absolutely dust proof.

Send for our sample box today (its free)



Buy

"DEVOE"

One Piece Formed Boxes

and save

"MONEY"

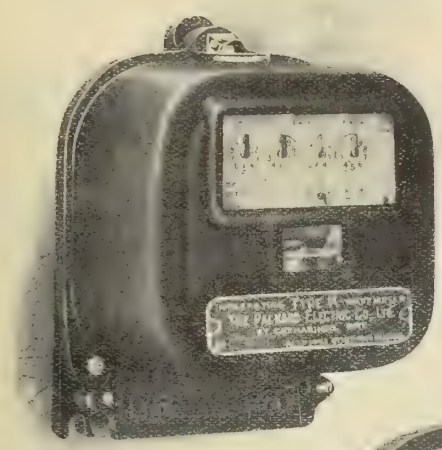
Write for Bulletin No. 2 on Boxes

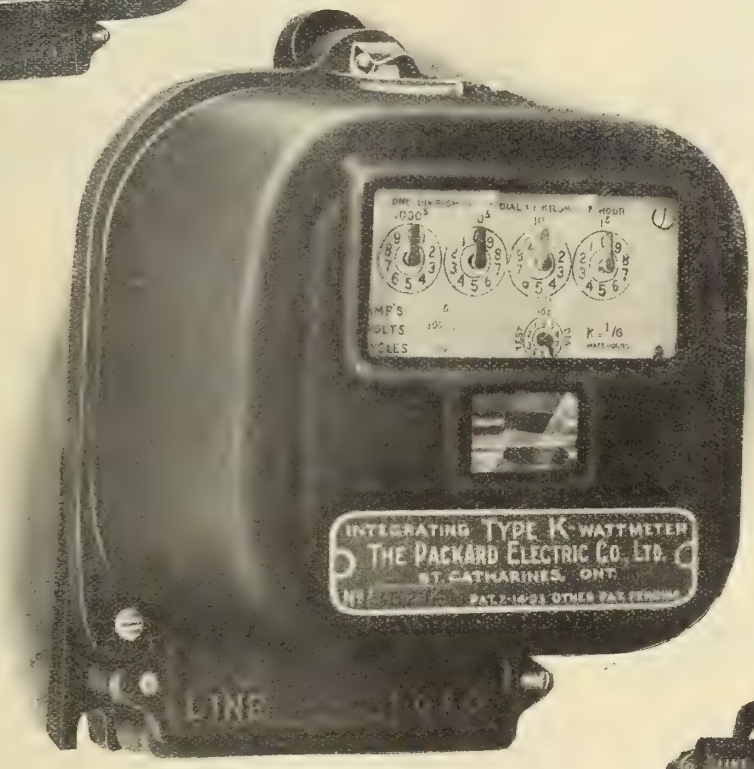
The Devoe Electric Switch Company

Office and Factory: No. 157 Craig St. West, Montreal

Packard

unexcelled for Accuracy, Reliability and Permanency of Calibration







Large Stocks Carried at

St. Catherines and Winnipeg; St. John Railway Co., St. John, N. B.; General Supplies, Limited, Calgary, Alta.; Rudel-Belnap Machinery Co., Canadian Express Bldg., Montreal, P. Q.

Get our quotations

The Packard Electric Company, Limited

Factory at ST. CATHARINES, ONT.

General Sales Office
Traders Bank Bldg., TORONTO

N. W. Office and Warerooms
WINNIPEG



A Toronto Product.

The Holophane Realite

the most efficient totally enclosing lighting unit made.

Are You Pushing It?

WRITE US FOR DETAILS

The Holophane Company, Ltd., Toronto

The Complete Outlet Box Line



View showing No. P & S 10 mounted on one of the standard 4 inch outlet boxes.

Do not use a makeshift. We have an outlet box receptacle for practically every condition.

P & S 10 shown herewith is but one of the large number.

Please note the porcelain projecting rim, making feasible the use of this receptacle on metal ceilings.

We also make one just like this, but without the porcelain projecting rim.

All of the big jobbers in Canada carry these goods in stock.

PASS & SEYMOUR, INC.

MAIN OFFICE AND WORKS:

Solvay, New York, U.S.A.

San Francisco—Rialto Building.

PLAIN FACTS

CLEVELAND FARE BOX

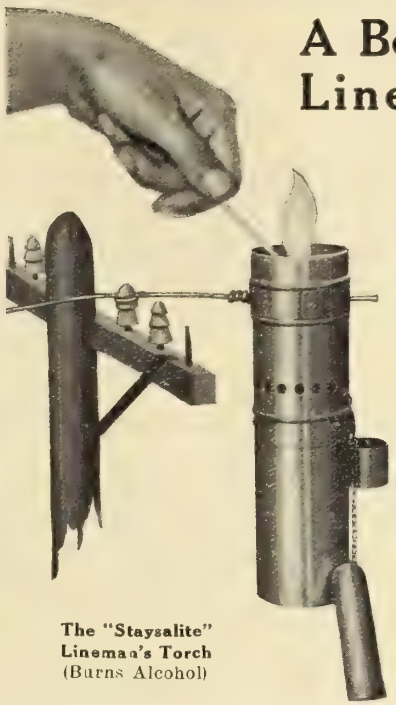


It is **SAFE** because the cash box automatically locks itself when being removed, and because all nuts, screws and bolts are inserted from the inside.

It is **STRONG** because it is made of aluminum, the metal that combines lightness with strength, while all working parts are of manganese bronze.

It is **DURABLE** because it remains operative under all conditions—weather conditions being no exception. It is the Fare Box that is being used on the biggest and most progressive Street Railways.

Cleveland Fare Box Co.
5310 St. Clair Ave., Cleveland, Ohio



The "Staysalite" Lineman's Torch
(Burns Alcohol)

A Boon to the Lineman Up the pole

And a Very Handy Outfit for Light Soldering Work Generally

ITS effective flame is always an instantly available source of heat, for soldering or similar use.

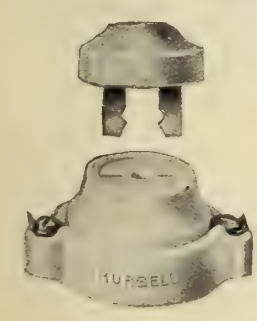
It is light in weight, small, easily carried in lineman's belt, stays alight in wind, is ideal for soldering joints, does away with ground man, is easily suspended on wire, provided with a cup for holding soldering paste, and is simple in construction with nothing to get out of order.

Mathias Klein & Sons
Canal Station 59 **Chicago, Ill.**

There is Good Earnest Money for the Dealer Who Sells Hubbell Attachment Plugs

The contractor profits by installing them in residences, hotels, hospitals and business buildings.
Central Stations benefit by increased consumption of current that follows sales of devices fitted with Hubbell Plugs.
The demand for Hubbell Interchangeable Plugs never ceases—constantly increases because they cost no more and do much more than common one-piece screw-in plugs.
Put them on your electric fans, lamps, and all other portable devices. They will help to sell your goods and always satisfy your customers.
Ask for a sample Plug and a supply of the new Hubbell advertising literature.

R. E. T. PRINGLE No. 95 King St. E., TORONTO



Cleat Base
No. 5512



Moulding Base
No. 5540

We Purchase Outright

entire issues of bonds on steam and electric railroad, gas, electric and hydro-electric properties.

N. W. HARRIS & CO.

Established 1882
Incorporated 1911

35 Federal Street, Boston, U.S.A.

Consider those two most important factors "SERVICE" and "MAINTENANCE"

when you are purchasing telephones. Realize that the financial success of your plant is dependent upon your ability to please your subscribers by making your service speedy and reliable and in cutting down every dollar of expense possible.

Put your money into Kellogg telephones and make a safe investment. There will be a big demand for your service. Every dollar spent will bring you, in return, service of the highest order. Service that has made thousand line exchanges from a small beginning of a few hundred lines.

There are ten thousand or more complete Kellogg plants in the United States which stand as evidence of this fact. Give us a trial order. Give us an opportunity to demonstrate the superior talking quality of our telephones.

Send for our bulletins which, aside from description of apparatus, contain valuable information on modern telephone practice. Kindly mention this magazine when writing.

KELLOGG SWITCHBOARD & SUPPLY COMPANY

CHICAGO, ILL.

CANADIAN SALES OFFICES:

REGINA—DEERING ELECTRIC LIMITED, WINNIPEG—HOUSTON & COMPANY, LIMITED



Corner of Tungstolier Show Rooms.

FOR YOU

¶ The New Show-Rooms of the Tungstolier Company of Canada, Limited, are FOR YOUR USE.

¶ Bring in your customers and use the show rooms—just as if they were your own.

¶ If you cannot conveniently call at our show rooms with your customers advise us they are coming—our specialists will look after them as well as your interests.

¶ Semi-Indirect, Showers, Mazda Box, Folding, Consolidated, Hammered, Classic, and T.T.C. Tungstoliers are displayed.

The Tungstolier Company of Canada Limited

Head Office:—4th Floor Canadian General Electric Building
Corner Simcoe and King Streets, TORONTO

Monarch Electric Co., Ltd.

St. Lambert, P. Q.

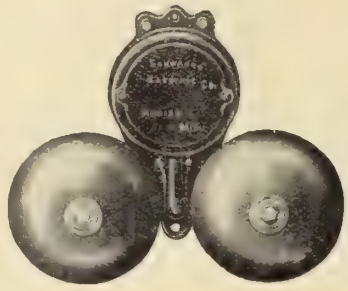
Phone Main 3988 Montreal Exchange **District Montreal**

A few of the Monarch Canadian Made Specialties manufactured in this, our own building, are:

Sockets—Rosettes—Attachment Plugs
Lamp Guards—Knife Switches



Oil Circuit Breakers
Switchboard Accessories
Switchboards
Transformers
for Instruments



We Have a Bell For Every Purpose

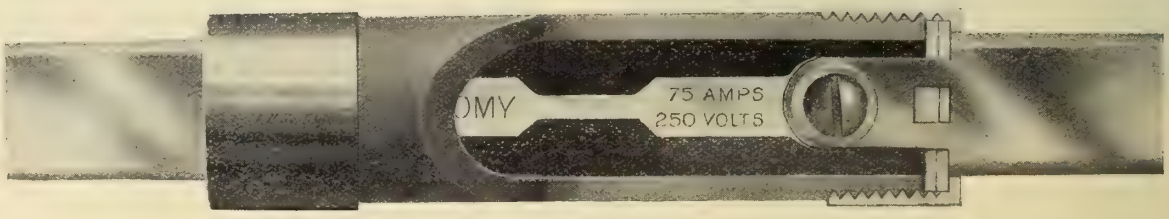
There can be only **one best** and that is the **Schwarze. No. 12 Common Magneto Extension** for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire **is all active.** Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and **very much louder,** and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof. **Write for catalogue.** **All resistances.**

Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
Second, because it is the only renewable fuse that is uniformly rated.
Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

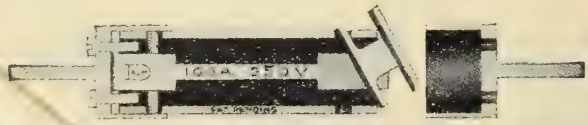
Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

Economy Fuse & Mfg. Co. of Canada, Limited

Herald Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.



Type "E" or Blade 61-600 A. 250 or 600 V

Refillable

ses for Electric Lights and Circuits are being
ted by all large users of Fuses.

IN TYPE
in the form of a FUSES, the fusible element is made
It will carry 10 cap. with capacities stamped thereon,
to blow at 25 overload indefinitely, and guaranteed
exact requirements, or less, which meets the most

CATALOGUES and SAMPLES for the asking

Sole Manufactu

A. F. DAUM COMPANY, TTSBURGH, PA.

DOSSERT CONNECTORS

are economical and efficient for wiring involved in the reconstruction or extension of existing generating and substations.

Where cables are to be joined or tapped to tubing or solid bus Dossert Connectors are invaluable.

Troubles due to faulty joints are eliminated, while costs are reduced by the facility and simplicity of their installation.

DOSSERT & CO., 242 West 41st St., NEW YORK

IRVING SMITH, Canadian Representative,
Unity Bldg., MONTREAL

Tungsten Lamp Bargains

High-Grade Pressed Filament Tungsten Lamps

All Lamps are Standard Edison Base unless otherwise noted

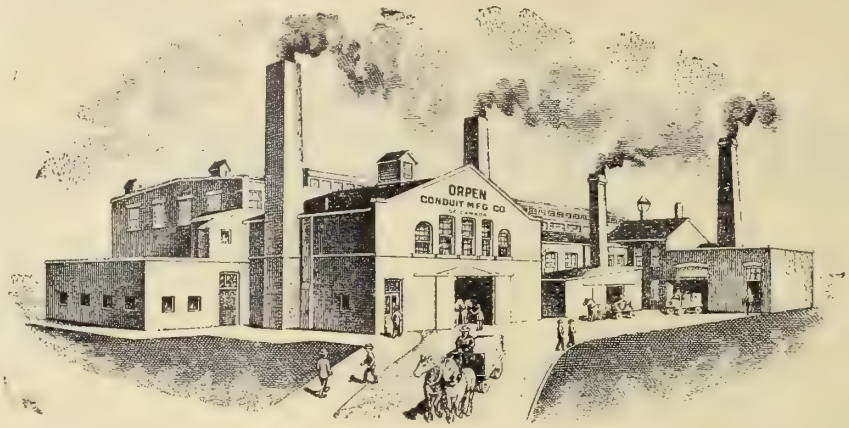
1800	25 C. P. 120 Volt 3⅛" Round Frosted (Packed 150 to Cask)	at	.20 Each
1200	150 Watt 120 Volt Pear Clear (Packed 100 to Cask)	at	.30 "
70	450 Watt 110 Volt Round Clear (Packed 10 to Cask)	at	2.80 "
10	450 Watt 110 Volt Round Clear (Packed 10 to Cask)	at	2.80 "
10	450 Watt 115 Volt Round Clear (Packed 10 to Cask)	at	2.80 "
100	550 Watt 110 Volt Round Clear (Packed 10 to the Cask)	at	3.25 "
90	550 Watt 120 Volt Round Clear (Packed 10 to Cask)	at	3.25 "
160	650 Watt 110 Volt Round Clear (Packed 10 to Cask)	at	3.60 "
480	550 Watt 110 Volt Round Clear (Packed 10 to Cask) Mogul Base	at	2.75 "
250	25 Watt 220 Volt Pear Clear (Packed 250 to Cask)	at	.40 "
500	25 Watt 230 Volt Pear Clear (Packed 250 to Cask)	at	.40 "
500	32 Watt 250 Volt Pear Clear (Packed 250 to Cask)	at	.40 "
250	40 Watt 250 Volt Pear Clear (Packed 250 to Cask)	at	.40 "
250	60 Watt 230 Volt Pear Clear (Packed 250 to Cask)	at	.40 "
250	60 Watt 235 Volt Pear Clear (Packed 250 to Cask)	at	.40 "
250	60 Watt 250 Volt Pear Clear (Packed 250 to Cask)	at	.40 "
1950	25 C. P. 120 Volt Round 3⅛" Frosted (Packed 150 to Cask)	at	.18 "
1550	20 C. P. 120 Volt Round 3⅛" Frosted (Packed 150 to Cask)	at	.18 "
1700	10 C. P. 110 Volt American Candelabra Twisted Flame Frosted	at	.18 "

At these prices orders will not be accepted for less than terms net 30 days F.O.B. Factory.

The Canadian Tungsten Lamp Co., Ltd.

Hamilton, Ont.

The home of XCELADUCT and ORPENITE CONDUITS



Queen and Dufferin Streets TORONTO

"XCELADUCT"

"Xceladuct" is a high grade of galvanized conduit made of easy-bending spellarized steel tubing, doubly protected against rust by copper plating and zinc coating. Every length is made up with clean threads and smooth enameled interior, allowing easy and rapid fishing.

INTERIOR CONDUITS

ORPEN CONDUIT MANUFACTURING Co. OF CANADA
MANUFACTURERS OF XCELADUCT ORPENITE CONDUITS
HEAD OFFICE TORONTO ONTARIO

Let us send Prices and Samples

"ORPENITE CONDUITS"

"Orpenite" Enameled Conduit is made of easy-bending spellarized steel tubing which is protected against rust and proof against all temperature conditions by coatings of specially prepared enamel. Each length presents clean threads and a smooth interior permitting of easy and rapid fishing.

THE ORPEN CONDUIT MANUFACTURING COMPANY of CANADA

TORONTO MONTREAL

—: STOP :—

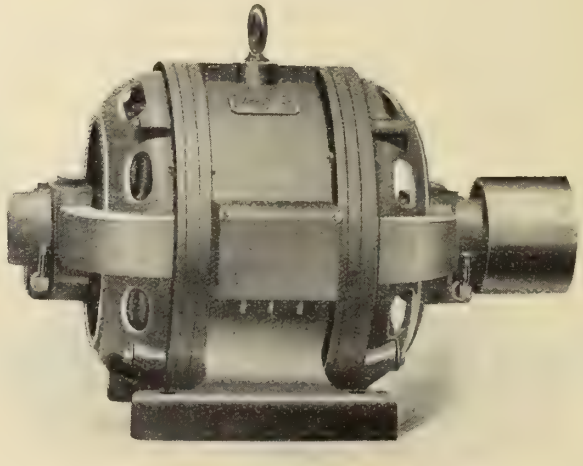
That's what you must do to read the following remarks, **BUT** it's what the **UNION** Motor **NEVER** does when once started and the current is kept on.

Learn all about it by asking for our Bulletins.

Canadian Union Electric Co., Limited

Head Office: 130 Wellington St., West, Toronto

Also at 9 St. Nicholas St., Montreal



Pattern H. D. Squirrel Cage Motor.

Represented in Winnipeg by:

The Mainer Electric Co., Limited

61-63 Albert St.



No. 986 Electric



No. 496 Squat Ceiling Bowl.



No. 8300 Pressed Electric



No. 4004 Electric

Moonstone Glass

In stock ready to ship at all times, Reflectors, Hemispheres, Spheres, Canteloupe Balls, Grecian Lanterns and Semi-Indirect Bowls which are also finished in Old Ivory, Bronze, Verde Green and Pink.



No. 994 Square Paneled Electric



No. 1030 Cylinder

Crystal Glass

In Electrics, RI or RO; Ball Globes, 4″ to 18″ dia.; Squat Ball Globes, 6″ to 10″ dia.; Squat Ceiling Bowls, 10″, 12″ and 14″ dia.; Ceiling Bowls, 7″, 8″, 10″, 12″, 14″ and 16″ dia.; Clear Ribs; Cylinders and Bell Electrics.

We are now prepared to furnish cut shades and balls in all styles of cuttings.



No. 1010 Electric



No 2000 Electric



No. 6024 Semi-Indirect Unit



No. 976 S. D. I.

The Jefferson Glass Company Limited

MADE IN CANADA

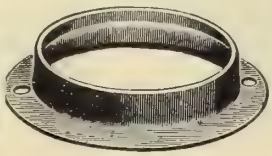
TORONTO CANADA

Made in Canada

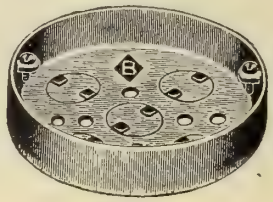
Iron Conduit—Conduit Boxes—Pipe Fittings and Accessories



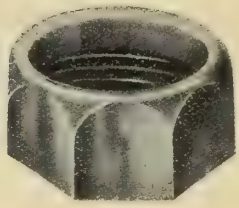
No. 635

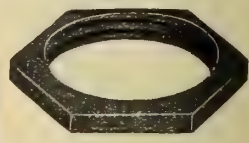


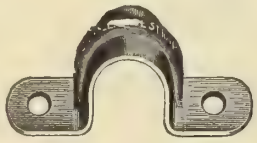
No. 31

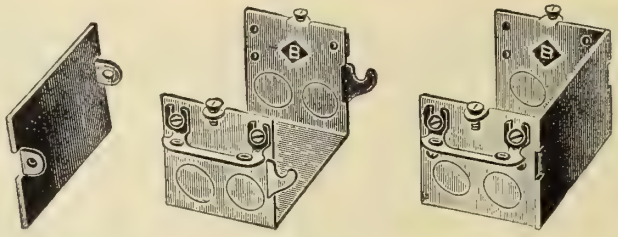


No. 18L







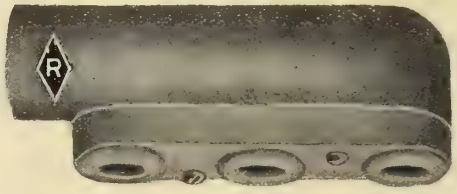


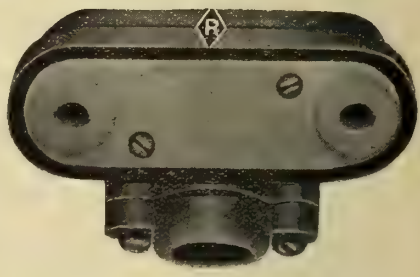
Type C 3″ deep—C C -2″ deep
Side comes off and does away with carrying two gangs

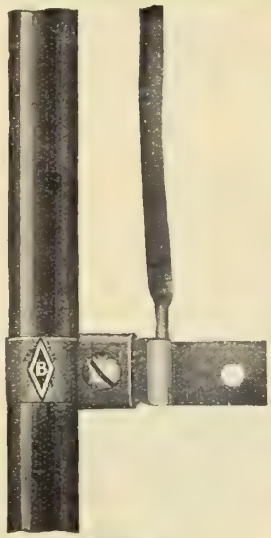


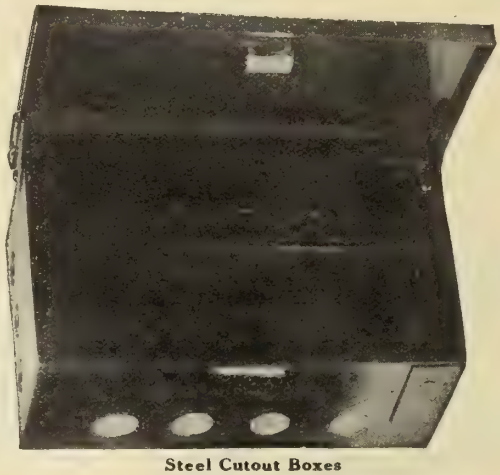
No. 81A



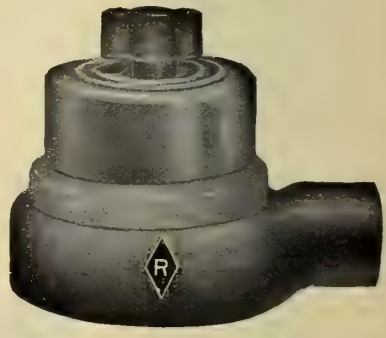






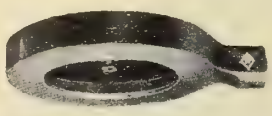


Steel Cutout Boxes









Type P





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Electrical Fittings Co., Limited

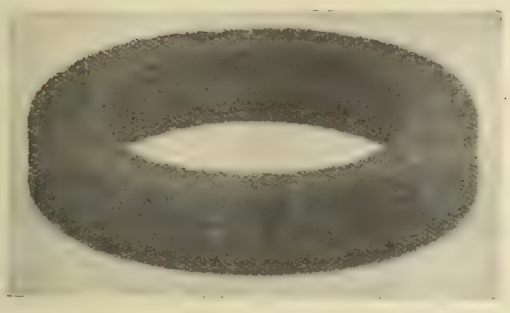
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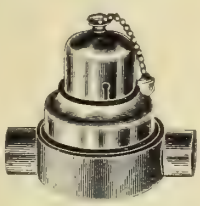


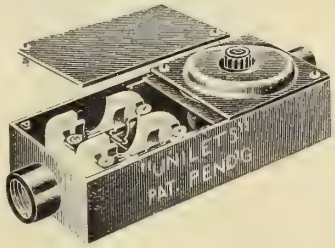
Cat. No. 9002


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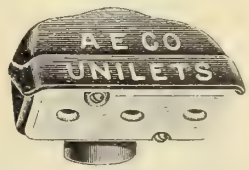

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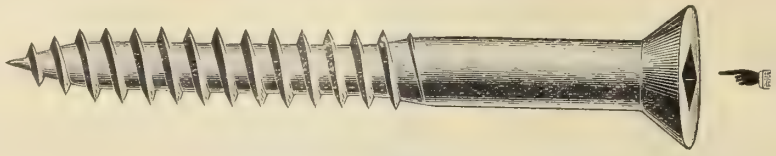
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PAT. FEB. 2, 1909

ROBERTSON SOCKET HEAD WOOD SCREWS

This new socket screw can effect a wonderful saving of time and material especially in electrical wire and fixture erection, etc.

They are used by simply placing the screw on the driver and then you may reach out at arms length and drive it in with one hand. For overhead work or work between joists or under flooring it is invaluable.

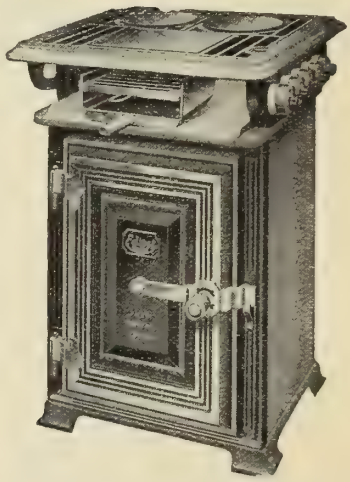
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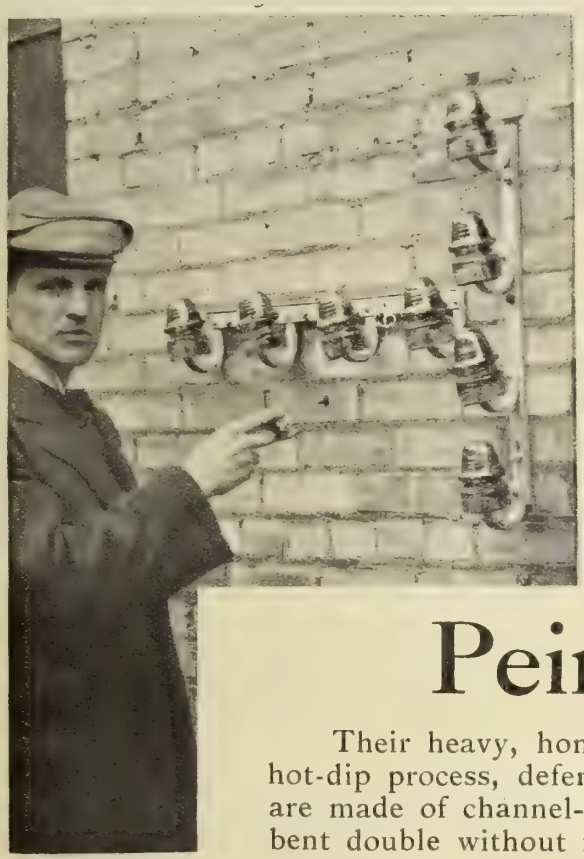
Will do everything a gas cooker will do, except smell and fume. Luminous Radiant Heat in Oven and Grill.

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and will require least maintenance cost, if you make it a fixed practice to use only

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which allow perfectly for expansion, contraction and inequality of bore, yet always hold the insulators securely.

For attaching Peirce Brackets to brick, stone or concrete walls, the "one best bet" is the

Peirce Hammer Drill and Peirce Expansion Bolts

The Peirce Hammer-Drill will drill a hole an inch deep in solid brick in less than a minute. It takes various sizes of drill points, which can be quickly removed for sharpening. Its reverse end is a hollow punch for upsetting the lead sleeves of Peirce Expansion Bolts—it forces the soft lead into every crevice of the brick. When properly installed, Peirce Expansion Bolts will pull off the face of the brick before letting go.





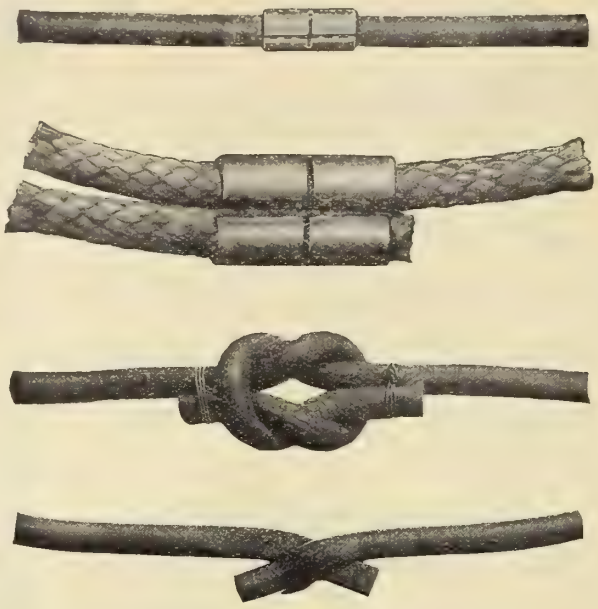


Peirce Specialties and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.

The Hardware MAKES the Line, Hubbard Makes THE Hardware

Hubbard and Company, Pittsburgh, U.S.A.

Which Way Is Better and Cheaper?



You can get a whole lot of real satisfaction and you can save a lot of money by using these little devices—

Keystone Cord Connectors

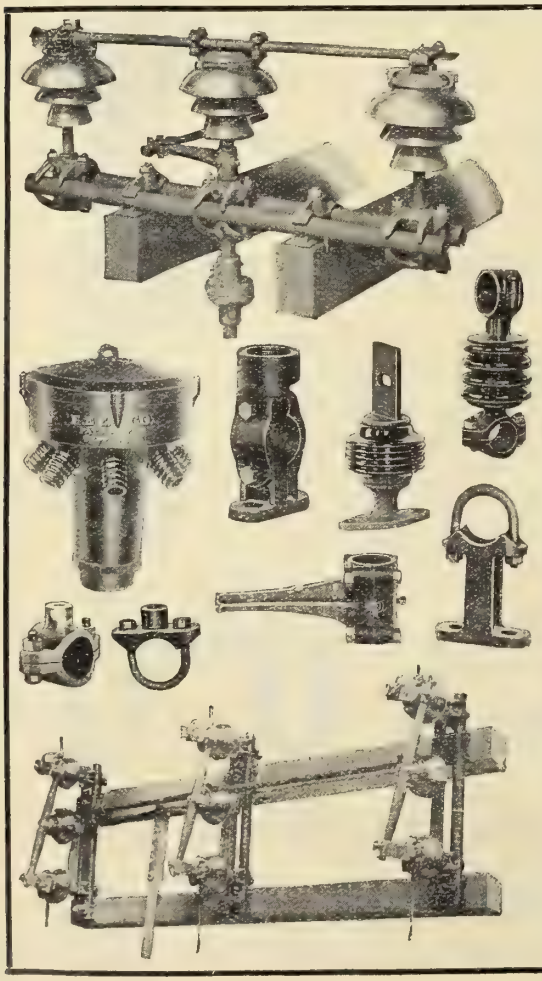
They are used for connecting together all kinds of cord, either cotton or leather, and are particularly adapted for connecting together either broken or new signal, bell or register cord. The finished joint is smooth and will travel through pulleys and guides as readily as the continuous cord.

Note that the Keystone Cord Connector is split in the middle, so making it easy to apply; and that the ribs on the inside of their soft steel shell have square edges that bite into the cord. Special pliers are furnished for applying, and connectors are furnished in either single or double types.

If you want to see a real cord connector, ask us for samples.

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Outdoor Pole Top and Station Disconnecting Switches in all capacities and voltages, Bus Bar Supports, Cable End Bells, Switchboard and Pipe Frame Fittings, Clamp Insulators, Station Pins and other Station and Transmission Specialties.

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Electrical News
Generation, Transmission and Application of Electricity

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 **Toronto, November 15, 1913** **No. 22**

Are You An "Expert"?

This apparently is an age of "experts." The atmosphere seems filled with "experts." The press with every issue creates "experts." And if by chance the press misses anyone, that person hastens to create himself an "expert." It is a title requiring no qualification, pre-supposing no knowledge, representing no experience, but it deceives the uninitiated. If it did not deceive it would be harmless; it would simply be laughable; but just in-so-far as it deceives the unwary it is to be condemned.

There was a time in bygone days when, for example, a properly qualified electrical engineer, a man of education and experience in his chosen profession, was considered a suitable person to consult in matters pertaining to electricity. That is all changed, however, and now it is the press-made, self-styled "expert" whose report is asked. We have the telephone "expert" with his stock-in-trade of prejudices and statistics, the railway "expert" whose name is a stranger to railway men, the wiring "expert" whose knowledge consists perhaps in having read a few catalogues, the lighting "expert" and so on—the air is full of them. One of the worst features of the situation, too, is that these "experts" are doing a lot of work and they are doing it as badly, and with as poor judgment, as possibly could be expected.

We do not mean to argue that a college education is a necessity before a good man can become reasonably proficient in the various lines of the electrical industry, though it helps, generally. What we do believe is that a man needs either theory or wide experience. If both are available so much the better, but the spectacle of an undertaking, involving perhaps millions of dollars, being advised upon by a man with neither, would be ludicrous in the extreme if it were not so costly financially. Yet our towns and cities are doing this very thing daily, entrusting important matters to, or following the advice of, self-styled "experts" and paying, both directly and indirectly, big money for their mistakes.

We do not pretend to be able to suggest an immediate remedy. The medical profession has been in existence for a long time and still "quacks" persist. In this case, however, the public has grown wiser with time and the laws of the land afford a measure of protection. Until we can legislate against incompetence in the electrical profession the market will doubtless be flooded with "experts," but in the meantime much can be done to educate the general public and especially the executive officers, such as councils, boards of control, etc. On these we would impress the necessity of employing engineers of reputation and experience, recognized among their fellows as trustworthy and capable, and known widely for the good work they have done. There are plenty such men ready to undertake work and deserving of it. This ability to descriminate would mean much to the engineers themselves, much to the electrical industry as a whole, but much more to the municipalities. Don't be deceived by the alluring title of "expert." In many cases it spells "quack." Be satisfied with a properly qualified and widely experienced engineer.

What to Give

Speaking of birthdays—well, they come around often enough. And do you know, many people dread them? No, not what you think—not because they are getting old, though that bad's enough, but for a very childish reason—they don't know what to give the birthdayee. And it's the same with anniversaries and the weddings which are going to be anniversaries sometime. Did you never see them in the stores? You can pick them out of the crowd anywhere by the hunted, worried expression, even if you are not near enough to hear the remark, "What **shall** I give those people?" To many persons, possessed of ample means to gratify their friends' taste, the approach of one of the occasions is a genuine calamity. They have thought out the general principle—it must be something of value, yet not too costly, unique without being trivial, ornamental but useful, something which will be of real service to the recipent and incidentally a reminder of the giver's thoughtfulness and good taste in selection—but they are helpless when it comes to the application.

From the many electrical devices for table use you can always be sure of finding a generous number that will fulfil all these conditions. Choose the one which after examination you feel that it will be difficult for you to get along without yourself, and you are apt to be on the right track. These utensils are so beautiful in design that they hardly suggest cooking—merely the pleasure of eating, rather. First ascertain if your friend's house is wired for electricity—it will be if it is a modern house—then come to our showroom and we will help you make a selection that will strengthen the bonds of friendship by the gift which you offer.—Electric Service Magazine.

Prince Rupert Dry Dock

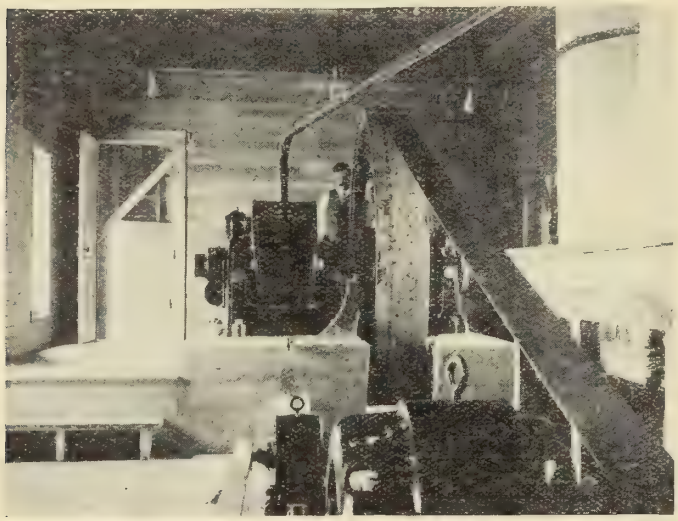
The new G. T. P. floating dry dock at Prince Rupert, B.C., will be one of the largest and best equipped in the world, and will be electrically operated throughout. The contract for the electrical equipment which has been awarded by the G. T. P. to the Canadian General Electric Company, Limited, includes two 200 h.p. and four 100 h.p. variable speed induction motors, with full automatic control, for operating the pumps on the dock. The power will be produced by two 1250 kv.a. Curtis steam turbo-generators with complete condensing apparatus. The exciters for the main turbine-generators will consist of three 35 kw. turbine-driven

generators, and one motor generator set. The foundry, machine shops, and ship yards will be equipped with motor-driven tools, requiring motors ranging from 60 to 10 h.p. The contract for electrical equipment also includes all necessary power and light transformers.

New Plant in Outlook, Sask.

Mr. Jas. H. Wilson, superintendent of the new municipal plant of Outlook, Sask., and town electrician, sends us the following brief description of their installation.

The motive power is a suction gas engine operated by producer gas. It is a Ruston-Proctor equipment supplied by the British Canadian Engineering & Supply Company of Winnipeg. Though some trouble was experienced in operating these units at first, owing to lack of experience with this



Producer-Gas-Electric Plant—Outlook, Sask.

type of prime mover, Mr. Wilson now reports that the engine has proved to be everything that the makers claimed for it and that it is giving good satisfaction.

The accompanying photograph shows the generator and exciter in the foreground and the engine in the back ground. The generator is a 50 kw., 2200 volt unit, belted to an engine of 75 h.p. capacity. A 2 kw. exciter is belted to the generator. Current is distributed in the usual way at 2200 volts and stepped down by pole type transformers to 110 volts. The plant commenced operation eleven months ago with only 45 subscribers but this number has been increased to 120 with 10 on the waiting list. The superintendent reports that all indications point to their having to install another unit in the course of the next year.

By-Law for Municipalities

According to a recent act of the provincial legislature every municipality in Ontario is required to appoint a properly qualified inspector who shall test all electrical installations of every kind and approve of them before they can be connected up to the feed lines. This looked as if it might work hardship to the smaller municipalities but where the expense is considered too great a number of municipalities are advised to combine on the appointment, the inspector being required to distribute his time to cover the larger territory as required. Strangely enough any opposition which has developed has come from the larger centres and the Hydro-electric Power Commission of Ontario, in whose hands the matter rests, have found it necessary to bring a certain amount of pressure to bear. This probably represents not so much an antagonistic attitude on the part of the municipalities as a disinclination to make any move for which the council may not understand the immediate necessity and which will add to the expense of operating the system.

Much of the delay has doubtless been caused, however, by a lack of knowledge as to just what course to pursue and the Commission have now drafted a by-law which each municipality may accept as it stands or use as a basis on which to build up a by-law more suited to local conditions. This by-law outlines certain general rules that are to be followed in the organization of an inspection department, the authority of the inspector, the schedule of fees, etc., which is untechnical enough for a council of laymen to understand. No doubt this will meet the requirements of the average municipality and result in the arrangement of an inspection department and the appointment of an inspector without delay. As already pointed out in these pages it is the natural conclusion that municipalities can be held responsible where accidents result as a direct failure to carry out the conditions surrounding electrical installations as required by law. The new by-law follows:—

Form of By-Law for Municipalities of Ontario

Whereas it is incumbent upon the Municipality of ..... (name of municipality to be inserted) hereinafter called the municipality, to appoint an electrical inspector or inspectors, hereinafter called the inspector, for the due enforcement of the Rules and Regulations of the Hydro-electric Power Commission of Ontario, hereinafter called the Commission, in accordance with Act 2, George V., 1912, section 22a (1) and (2), it is hereby enacted by the Council of the said municipality that:—

1. Use of Electric Current.

No electric wiring or apparatus shall be installed nor shall electric energy be used for lighting (illuminating, decorative or advertising), power, heating, electro-chemical or other like purpose, except as hereinafter provided.

2. Electrical Installations (Rules to be observed).

The Rules to be observed in the installation of electric wiring, fittings, apparatus or machinery, shall be known as "Rules and Regulations for Inside Electrical Installations" of the Commission, together with such modifications, amendments or additions as may from time to time be approved of by the Commission.

3. Method of Enforcement of Rules.

a. No installation of electric wiring, fittings, apparatus or machinery shall be made, nor shall any alterations or additions be made to any existing installation, until a permit has been obtained from the Inspector for the carrying out of such work.

b. The Inspector may refuse to issue a permit if, in his opinion, the proposed installation will not conform in every respect to the requirements of this By-law.

c. It shall be the duty of any person or persons installing electric wiring, fittings, apparatus or machinery to notify the Inspector (on forms which will be supplied by the Inspector) when any such electrical work is ready for inspection. At least twenty-four hours' notice must be given in all cases.

d. Each application for an inspection shall be accompanied by an amount of money sufficient to cover the inspection fee, as set forth in the schedule given herein.

e. Wiring contractors shall see that proper notices are placed in conspicuous locations warning carpenters, lathers or other persons concerned, not to cover up the wiring until it has been duly inspected. Copies of such notices may be obtained from the Inspector.

f. When the Inspector has had inspected and approved any installation he will cause a notice of approval to be placed in a prominent place where it may be seen by carpenters, etc., who will then be at liberty to cover in the wiring.

g. Information may be lodged with the Inspector by any member of the local police force or fire department or other

person respecting any electric wiring which there is reason to believe is being installed without a proper permit having been issued therefor.

4. Supply of Electrical Energy—Service.

a. No company, corporation or individual, whether operating publicly or privately, will be permitted to install any live service or furnish a supply of electrical energy to any installation for electric light (illuminating, decorative or advertising), heat, power, electro-chemical or other like purpose, until a permit has been granted therefor by the Inspector.

b. The Inspector may, at his discretion, issue permits for temporary service, should these be required.

c. Any company, corporation or individual supplying electrical energy within the limits of the municipality shall, upon the written notice from the Inspector, to the effect that the electric wiring, apparatus, etc., in any premises is in an unsafe condition, discontinue within forty-eight hours the electric service or services from such wires, etc., and must not re-connect the same without a written permit from the Inspector to do so.

5. Organization of Inspection Department.

a. The Inspector is hereby authorized to organize, manage and conduct a department to be known as the Department of Electrical Inspection, hereinafter called the Department, for the due enforcement of the Rules and Regulations of the Commission in the manner set forth in this By-law.

b. The Inspector will have complete control of any or all assistants or other staff which may be necessary for the proper execution of the work of the Department.

c. Before engaging any assistants or other staff, however, the Inspector shall submit a report to the Mayor of the municipality, stating his requirements, together with an estimate of the expenditure of the Department for the ensuing year.

d. It shall be the duty of the Inspector to submit a report each year at a time to be appointed by the Mayor of the municipality, detailing the work which has been carried out by the Department during the preceding twelve months, giving the number of permits issued and inspections made, the amount collected in fees and other such information as the Mayor may require.

e. It shall be the duty of the Inspector to keep such books as will show a proper record of all the transactions of the Department, and he shall, at the beginning of each calendar month, hand over to the Treasurer (or such other person responsible for the funds of the municipality) all the funds collected in the form of inspection fees during the previous calendar month.

f. It shall be the duty of the Inspector to inspect, or cause to be inspected, as quickly as circumstances will permit, all new installations for the inspection of which he has received formal application accompanied by the proper inspection fees, and also to make such re-inspection of existing installations, additions or alterations thereto as may be necessary, in order to minimize the risk of injury to persons or danger of fire.

6. Authority of Inspector.

a. The Inspector, or any of his authorized assistants to whom he may delegate such duty, is hereby empowered to enter upon at any reasonable hour the stage or other portion of a theatre, moving picture establishment, or other place or public assembly wherein electrical energy is used for light, heat or other purpose, either temporarily or permanently, for the purpose of examining the electrical equipment therein or for the purpose of witnessing its use in such places, and he or they are further empowered to enter upon any other premises at any reasonable hour for a like purpose.

7. Settlement of Disputes.

In case of any dispute arising (as to the proper method of carrying out work on any electrical installations or the materials to be employed therein) between wiremen, contractors, or other parties concerned, the Inspector shall decide the matter in dispute.

Should, however, the decision of the Inspector be regarded as unsatisfactory or unjust by those whom it affects, they may apply to the Commission for a ruling, in which case full particulars in writing, setting forth the facts, must be furnished to the Commission and all other parties concerned. Any order made thereon by the Commission shall be final, and disobedience thereof will render the party or parties at fault, liable to the penalty prescribed for such cases under Section 22 of the Power Commission Act of 1912.

8. General.

a. No person shall damage, or interfere with any electrical installation, or portion thereof, which has been inspected or approved by the Inspector, and no person shall leave or place any metal pipe or other metal work in contact with any electric wiring; nor shall any person molest, obstruct or interfere with the Inspector, or any of his assistants, in the proper discharge of their duties under this By-law.

b. This By-law covering inspection work shall apply to all places and premises situated within the limits of the municipality, wherein electrical energy is used, whether the supply be taken from a private or public source.

9. Penalty for Non-observance of Rules and Regulations.

Any corporation, company, contractor or individual violating any of the within Rules and Regulations will be subject to the penalties set out in the Power Commission Act of 1912, as well as those set out in any By-law passed by any Municipal Council in pursuance of Part 22 of the Municipal Act, 1913.

APPROVED SCHEDULE OF FEES.

Incandescent Light Wiring.

1 to 5 outlets	$0.50
6 to 10 outlets	$1.00
11 to 50 outlets	.05 each additional.
51 to 100 outlets	.02 each additional.
and over 100 outlets	.01 each additional.

Motors

Electric motors, each	$1.00
Each additional motor in same plant	.25

Electric Signs.

Electric signs, each	$1.00
More than one sign on same building	.50 each additional.

Electric Fixtures—Mercantile and Factory Buildings.

For certificate covering complete fixture installation along with wiring and for same contractor, a charge of $1.00 over and above the wiring inspection fee will be made.

Residential Fixture Inspections.

When fixtures can be inspected along with wiring, a charge of 25c. over and above wiring inspection fees will be made. When special fixture inspections are required or necessary a charge of one-half the wiring inspection fee will be made, rating each fixture as an outlet with a minimum fee of 25c.

Special Inspections.

Where no special fee is provided, inspections may be made at the rate of 50c. per hour, as well as any actual travelling expenses.

Permit Fees.

Note.—Permit fees will be credited on final inspection fee.

For each permit for wiring jobs under $10.00 (estimated value)	$0.10
For installation between $10.00 and $50.00 (estimated value)	.25
For installations over $50.00 (estimated value)	.35

Each job is entitled to as many inspections as circumstances, in the opinion of the Chief Inspector, warrant.

Shows at Toronto and Montreal

The Montreal Electrical Show, held in the Arena from November 1 to 8, was of a popular rather than a technical character. It contained features of interest to certain classes of electricians, but in the main was composed of exhibits of electrical household appliances. In this sense it was of educative value, as making for the wider use of goods in which electricity is employed as the medium either in the form of power or light. The large increase in the demand for electrical cooking and heating devices is sufficient proof of public appreciation of the claims that the devices are convenient, clean, and economical.

The Montreal Light, Heat and Power Company was the chief exhibitor, occupying a large space at the entrance hall. As was natural in a lighting company, they had a well illuminated stand, on which were displayed many heating and cooking appliances, such as electric chafing dishes, water cups, irons, percolators, table range, complete stoves, washers, and an array of lamps. The exhibits, chiefly manufactured by the Simplex Electric Heating Company, Belleville, Ont., showed what can be done in the way of using electricity for cooking and heating purposes—and demonstrations were given of the excellence of electrical cooking. The Montreal company also showed a device for testing lamps and were demonstrating the comparative illuminating power of Sunbeam mazda lamps and the old type carbon lamp.

The George H. Shuman Electric Company, of New Birks Building, Montreal, showed samples of the goods of the National Electric Heating Company, Toronto. These included electric mantle radiators and heaters, and similar products. They also had on view many Ile-wire drawn tungsten lamps, for which they are Canadian distributing agents.

An exhibit which attracted much attention was that of the Lister-Bruston automatic electric generating plant, an English invention sold by R. A. Lister & Company, Toronto. The plant consists of a low speed vertical gasoline engine, dynamo, switchboard, and controller. It is especially useful for country house lighting and pumping, and is claimed to be economical in use, obviating the necessity for large storage batteries. The engine, which can be run by gas or gasoline, is started by the simple act of switching on the lights and stops automatically when the lights are switched off.

A very attractive display was shown by the Montreal Electrical Society. This was contributed to by the Imperial Wire and Cable Company, the Bell Telephone Company, Northern Electric & Manufacturing Company, Montreal Light, Heat and Power Company, telegraph department of the C. P. R., and members of the society. The stand was divided into sections of the electrical industry, such as power, manufacturing, cable and telephones, etc., represented by the various committees of the society. Thus there were specimens of different cables, wires, cords and materials, and a sample of the first paper insulated power cable made in Canada. The Bell Telephone Company lent samples of the different instruments, receivers, etc., from the earliest days; other exhibits included the complete parts of an Edison storage battery, parts of a 50 kw. transformer and a model of the Montreal Harbour Board's electric transporter.

Mr. E. W. Sayer, of Montreal, had an effective display of lights and shades, and also miscellaneous electrical appliances.

The Boys' Wireless Club of the Y. M. C. A. worked a wireless apparatus, sending messages from one end of the building to the other, and the Technical School showed some small electrical apparatus.

A large collection of X-ray apparatus was to be seen on the stand of X-Rays, Limited, this including a very powerful X-ray transformer and the latest inventions applicable to this branch of electrical science.

Tate Electrics, Limited, Walkerville, Ont., showed two electrical commercial trucks and two pleasure vehicles, one being a very fine brougham suitable for city use.

There were also a number of electric vacuum cleaners on exhibition, including the Tuec and Ohio.

The Toronto Exhibits

The Toronto exhibition which is just getting under way as we go to press promises to be full of interest and information to the general user of electricity. The following list of exhibitors indicates the amount of interest taken by the manufacturers and dealers, in the exhibition.

Factory Products Limited have a very attractive display, including electrical appliances and supplies of practically every description.

The Toronto Hydro-electric System have also taken considerable trouble. Their exhibit shows an ideal dining-room (from the electrical standpoint); an ideal office; an ideal kitchen; an ideal bedroom and an ideal machine shop. The lighting units were supplied by the Tungstolier Company and the Holophane Company.

The Lancashire Dynamo and Motor Company are exhibiting dynamos and motors and an automatic fire alarm system.

A. H. W. Joyner's display consists chiefly of electrical instruments of the well-known Weston type.

The Hydro-electric Power Commission of Ontario are showing their model farm equipment.

The Humane Society are giving a demonstration of a cage for destroying smaller animals by electricity.

Chapman and Walker Limited have a variety of electrical machine supplies and household equipment.

The Chamberlain and Hookham Meter Company are displaying a number of meters.

The Engineering Society of the Applied Science Department of the University of Toronto are represented.

The Onward Manufacturing Company are demonstrating their latest types of vacuum cleaners.

The Jefferson Glass Company are displaying a quantity of their handsome glassware and also giving a demonstration of glass cutting.

R. A. Lister & Company show an isolated gas-electric lighting plant suitable for villages or isolated residences.

Jones & Moore are exhibiting a variety of electric motors and supplies.

J. J. Martindale is demonstrating his Tuec stationary vacuum cleaner. The Canadian Carpet Cleaning Company are also demonstrating one of the Tuec machines.

The Canadian Carbon Company have an attractive exhibit of dry cells, flash lights and a variety of carbon products.

The Canadian Krantz Electrical Manufacturing Company show panel and switchboard supplies.

The Canadian Independent Telephone Company are demonstrating an inter-communicating telephone system.

The Vacuna Turbine Vacuum Cleaner Company are exhibiting a number of their machines.

E. F. W. Sallisbury, electrical contractor, is exhibiting telephones, motors and general supply parts.

The Clements Manufacturing Company have a display of vacuum cleaners.

The Zimmer Vacuum Cleaner Company are demonstrating their vacuum cleaners.

Tate Electrics Limited are showing an electric pleasure vehicle and an electric truck equipped with Tate batteries.

The Electrical Maintenance and Repairs Company are exhibiting lighting fixtures and general supplies.

Death & Watson, electric cars and storage batteries.

The 1900 Washer Company are demonstrating their electrical washing and ironing machines.

Hollow Reinforced Dam at Jordan River

The Vancouver Island Power Company, Limited, a subsidiary concern of the British Columbia Electric Railway Company, Limited, have placed themselves in a position to become one of the most important producers of electrical energy in the Dominion by the completion of the great dam at Jordan River, a work which was undertaken to meet the increased demand from the city of Victoria and environs upon the company's hydro-electric plant there. In addition to the constantly growing industrial demand for light and power in the Saanich peninsula, an increased storage capacity has also been found necessary for the purpose of keeping pace with the extensive development of the tramway system of the B. C. Electric Railway consequent upon the remarkable growth of Victoria and the districts adjoining.

The Jordan River plant is situated at the mouth of the Jordan River on the Strait of Juan de Fuca, about 43 miles from the city of Victoria, the plant at present in operation comprising two electrical units of 6000 h.p. capacity each. Energy is transmitted at 60,000 volts to Victoria and a tie line connects this plant with the auxiliary steam power plant of the Vancouver Island Power Company at Brentwood Bay.

On account of the increased load on the system the capacity of the Jordan River plant will be enlarged by the addition of one 13,000 h.p. unit, bringing the total capacity up to 25,000 h.p., and thus rendering necessary the construction of the Jordan River dam. Prior to the construction of the permanent dam the waters of the Jordan River were diverted by a temporary rock filled crib dam, located a short distance above the site of the permanent dam, into a flume 6 feet in width by 5 feet 9 inches deep, and 6 miles in length, built with a grade of 1 in 1,000. The water was delivered by the flume into the forebay reservoir, formed by the construction of two earth dams, whence it was conveyed through steel pipe lines to the Jordan River power house. Additional storage was secured by the construction of a hydraulic fill dam on Bear



Upstream side Jordan River Dam.

Creek. The waters of Wye Creek were also diverted into the main flume by means of a rock filled crib dam, and the steam known as Alligator Creek has been diverted in a similar manner.

The area of the Jordan River watershed is 67 square miles; the effective drainage area has been found to contain 55 square miles, while the elevation of the effective drainage area is all more than 1200 feet above sea level. The elevation of the watershed is from sea level to 3,000 feet above sea level.

The contract for the building of the permanent dam was awarded the Puget Sound Bridge and Dredging Company at the beginning of August, 1912, and active construction work inaugurated immediately, the entire undertaking requiring just one year to complete. The work consisted of the erection of a hollow reinforced concrete dam of the Ambursen type, together with about seven hundred feet of wooden flume and a small reinforced concrete arch bridge for carrying the flume across the Jordan River. Various types of dams had to be considered, and as it was important to store the autumn rainfall of 1912, an early date for the completion of the work was essential. No sand being available in the vicinity, it became apparent that a dam containing a minimum quantity of material would be required and the Ambursen type of dam was therefore finally decided upon.

The completed dam is about 125 feet high in the highest



Down-stream side Jordan River Dam.

section and 890 feet long over all. Of this length there is 452 feet of bulkhead or non-overflow section, 306 feet of spillway and 135 feet of earth embankment with reinforced concrete core wall. The deck or upstream side of the dam is built on a slope of approximately 1 to 1 and the downstream face of the buttresses on a slope of 1 to 4. On top of the bulkhead section there is provided a walkway six feet wide, which is protected by suitable hand rails and connected at each end of the spillway by stairs with another walk which passes entirely through the dam. The spillway has an eight-foot freeboard and provides for a flood discharge of 25,000 cubic feet per second.

Water is drawn from the reservoir through two sets of Coldwell-Wilcox cast iron sluice gates, each set consisting of two 3 ft. 6 in. x 5 ft. 6 in. gates, either of the sets being capable of discharging sufficient water to supply the demand, except at extremely low water. The gates are all operated by roller-bearing, hand-power hoists set inside the dam, the stems passing through stuffing boxes in the deck. Guides for stop logs are provided for shutting off either set of gates if necessary, and the whole is protected by two sets of trash racks which are mounted on trucks and can be raised clear to the top of the dam if necessary, for cleaning. There is a suitable hand-power winch for raising the racks located on the top of the dam. Heavy concrete counterweights are provided to assist in raising the racks. The storage capacity created by the dam is approximately 615,000,000 cubic feet of

water or sufficient to supply all the electric power at present used in Victoria for five months. With the additional supply of the Bear Creek and forebay reservoirs there is enough stored energy to provide Victoria's power needs for eight months.

Dam Site

The site chosen for the dam proved to be well adapted to the type of dam built and for the efficient location of most of the construction plant. The profile of the site is such that work could be prosecuted on any part of the structure except in the five bays in the river bed, irrespective of the flood conditions of the river. This fact proved of the utmost value during the winter months when the river was subject to sudden and destructive floods.

Solid bed rock was uncovered for the foundations of the entire structure without excessive excavation. This rock provided an ideal foundation, being extremely hard and free from



Crest of Jordan River Dam.

seams and faults. The grain of the rock, and what seams there are, run in a direction parallel to the axis of the dam, thus reducing the possibility of a leakage of water to a minimum and making it easy to secure a satisfactory cut-off for the entire length of the dam. The site also provides an excellent location for the spillway. The waste water after passing over the dam will be discharged into a natural channel which will carry the water away from the dam rapidly and discharge it into the river at a point far enough from the dam to prevent the possibility of damage from cross wash or any scouring action. The greatest difficulty with the site was the impossibility of building a tight cofferdam on the loose gravel and boulders which formed the river bed.

Plant

In general the equipment consisted of the following machinery: two stiff-leg derricks, one 50-ft. and one 60-ft.; boom, with hoisting engines and boilers and an assortment of one-yard wooden skips all used on excavation work on the east bank of the river; one steam-driven compressor operating two Rand drills in the quarry; four one-yard Koppel cars; two No. 2 Aurora jaw crushers; one rotary sand screen; two 24-in. x 30 ft. Superior sand rolls; one 1-yard Kohring mixer, and one half-yard cube mixer; three 1-yard centre-dump concrete buckets; two concrete distributing cars; one cableway of about 900 ft. span equipped with 2¼-in. standing line and specially designed carriage and operated by a two-drum hoisting engine; carpenter shop with circular saw and blacksmith shop with two forges, hand power drill press and bolt machine with capacity up to 1½-in. bolts; three centrifugal pumps (one 10-in., one 8-in. and one 5-in.). All machinery except derricks, cableway and compressor was driven by electric motors with power furnished from the company's plant at the mouth of the river, a seven-mile transmission line having been built for the purpose. Power was transmitted at 6600 volts and stepped down at the works to either 2200 or 220 volts as required. Sheds were provided for the storage of cement, having a capacity of about 75,000 sacks, in connection with which there was a testing laboratory equipped for making the usual tensile tests on cement.

Under the terms of an agreement with the city of Victoria the initial expenditure on the Jordan River power plant by the Vancouver Island Power Company amounted to $1,500,000. To this sum must now be added the cost of the dam, totalling $550,000, together with another expenditure of $450,000 to enlarge the existing generating plant. The work of erecting the dam was under the supervision of Chief Engineer Mr. G. R. G. Conway and Mr. G. M. Tripp, engineering superintendent of the company, and his assistants, Mr. C. A. Lee, resident engineer, and Mr. W. Faust, superintendent of construction. A complete inspection of the plant was recently made by Mr. Wm. Young, controller of water rights. Mr. E. Davis, engineer of the provincial water department, accompanied by Mr. G. R. G. Conway and Mr. Tripp. The work impressed the government officials as being carried on in the most thorough manner possible.

Electricity in Poultry Raising

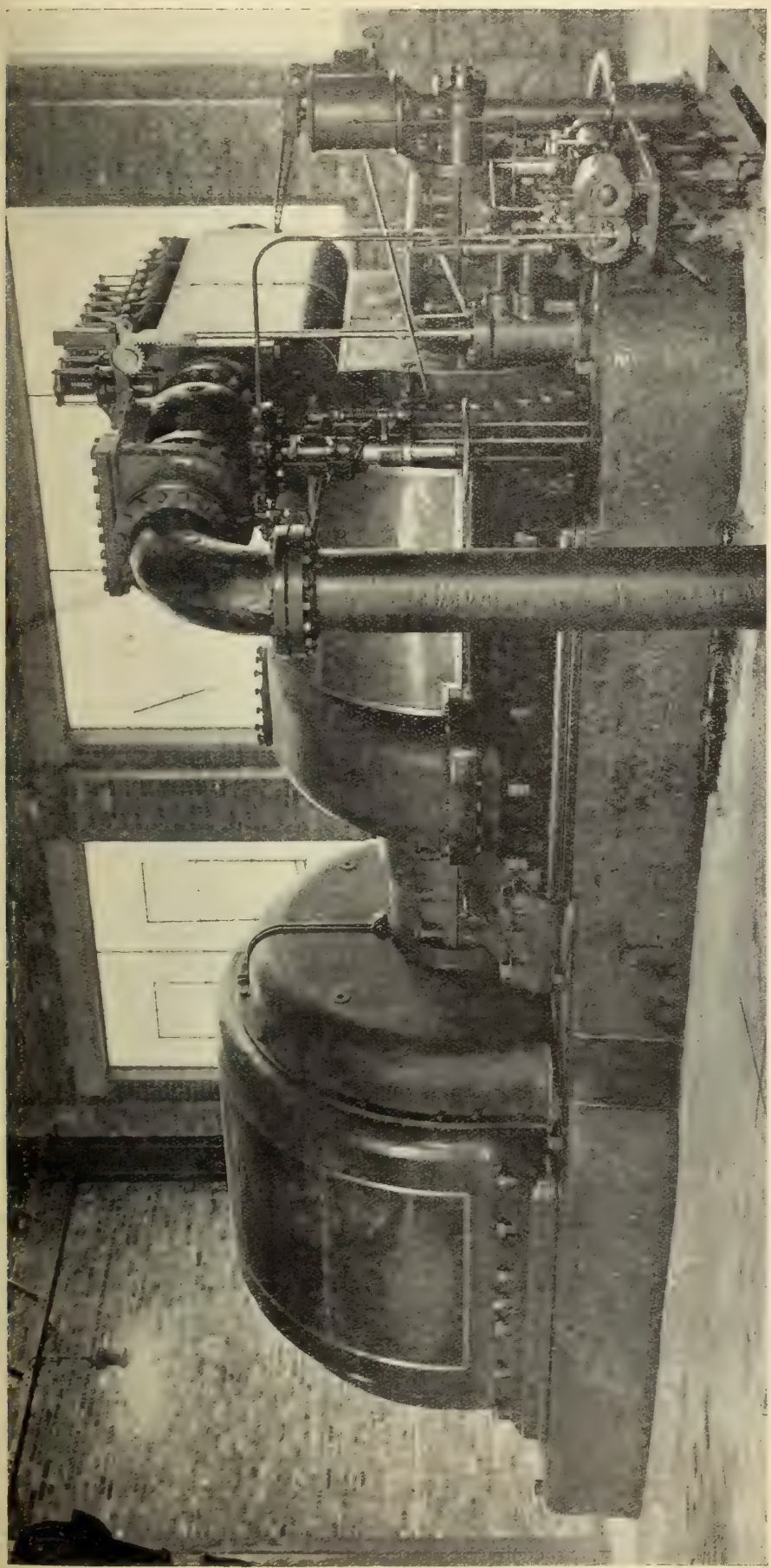
The last weekly report of the Department of Trade and Commerce contains the following item on the experimental use of electricity in poultry raising:

"Experiments have been carried out by Mr. W. H. Cook, at Orpington, Kent, England, where nearly 200 yards of fowl houses, containing 6,000 birds, on Mr. Cook's poultry farm have been artificially lighted during the dark mornings and early nights since Christmas last, and he states that his total increased output in eggs during the dark months by this system has been between 30 and 40 per cent. His fowl houses are lighted by 300 lamps, divided into 32, 16 and 8 candle powers. These are switched on at six o'clock in the evening. At 9.30 the 16 candle power lamps are employed, and at 10 o'clock the 8 candle power lamps are substituted for a quarter of an hour before the hens are left in darkness. Mr. Cook explains that it is necessary to give a rough imitation of the setting sun, otherwise the hens would go to sleep on the ground and become a prey to parasites. In the case of young artificially incubated chickens the electric light is employed to make them feed longer, and this Mr. Cook has found accelerates their growth during the winter months by almost one-third."

Fort William Electric Railways

The principal topic of conversation heard on the streets of Fort William the past week or more has been the question of operation of the municipal street railway. At a meeting of the city council held Saturday evening, November 1st, it was decided by a vote of 11 to 2 that Fort William would manage separately the Fort William end of the Port Arthur-Fort William street railway, which heretofore has been managed by a joint board of representatives chosen from the two cities. The original charter for the Port Arthur-Fort William street railway was obtained over twenty-two years ago. It will be twenty-one years next March since the street railway has been in operation between the two cities. On December first of the present year Fort William will take over the management of the street railway within the borders of her own boundaries and will operate it as a public utility. Already arrangements have been about completed towards equipment, maintenance, car barns, etc., and it is practically assured that the city will be able to undertake complete management within the time specified.

10,000 Kw. Turbo-Generator for T. E. L. Co.



The Toronto Electric Light Company have just completed the installation of a 10,000 kw. steam turbo-generator—the largest to date in Canada.

The Toronto Electric Light Company have just placed in operation a turbo-generator set of a normal rated capacity of 5,000 h.p.. The turbine is a Curtiss condensing type unit operated under 150 pounds pressure and manufactured by the Canadian General Electric Company. The same company also supplied the generator which is a 12,000 volt, 25 cycles, 1500 r.p.m. unit. This set has a continuous over-load capacity of approximately 9,500 kw. and is, we believe, the largest of its type in Canada.

The set is installed in a newly erected building which is well supplied with both natural and artificial illumination. The whole of the east and west sides of the power house is windowed. Night illumination is supplied by 250-watt tungstens, with steel reflectors, placed well up. The power house is also equipped with a Northern crane of 20-ton capacity.

The turbo-generator unit is installed on the second floor of the building, the floor below being occupied by the condenser which sits right under the turbine. For the foundation, excavation was made to bed rock 19 feet below the surface and this was filled up to the first floor level with a solid block of concrete 30 ft. x 15 ft. Above this the big turbo-generator is supported on six heavy concrete pillars approximately 3 ft. x 4 ft. As a result of the great care exercised in the installation not the slightest vibration is shown in any part of the equipment. The condenser is electrically driven by a 200 h.p., 230 volt direct current motor. The field control is also motor operated.

All control is from the operator's table at a point remote from the equipment. This unit will be kept for emergency purposes only and it has been demonstrated that in 2½ minutes after the signal is received the generator can be supplying current to the line.

The Toronto Electric Light Company with this last addition is now in a position to supply at least 20,000 kw. in case of trouble to both their Niagara lines. This is further supplemented by a storage battery which is capable, by itself, of carrying the peak hour load for several minutes or until such time as the turbo-generators can all be set in operation.

As noted above the units are all controlled from the operator's table. In case of trouble on the Niagara lines a signal is automatically given to the operator and at the same time the storage battery is automatically cut into service. At the same instant the condenser motor of the big turbine is thrown in and the boilers, which are all operated by automatic stok-

ers, also motor-driven, are called into service. In less than two minutes and a half the new turbine will be supplying power to the line and the other two turbines, previously installed, can be brought into requisition in about six minutes. In order that the boiler capacity may be ample, four new boilers are at present being erected, each having a capacity of about 1500 h.p.

It may also be mentioned in connection with the T. E. L. plant that they have recently placed in commission a 1,000 h.p. synchronous converter, one of the few machines of this type to be operated in Canada as yet. This machine shows advantages both in space and efficiency. The space occupied is not more than half that required by one of the older type of motor-generator units and it has an efficiency of between 97 and 98 per cent., as compared with a lower efficiency for the old machines.

Mississippi River Power Company

We are reproducing on other pages of this issue three photographs of the Mississippi River Power Company's plant at Keokuk, Iowa. According to the latest bulletin there are now eleven units successfully operating with a capacity of 10,000 h.p. each. Five more similar units are being installed as rapidly as possible and will be ready for business as it develops. The ultimate capacity of the plant will be 30 such units.

The dam consists of 119 arches and spillways. Each spillway is 30 ft. wide and is closed by a steel gate 11 ft. high and 32 feet long. The dam is 42 feet wide at its base and has an average height of 31 ft. with an additional 21 ft. for the operating bridge. The dam and the bridge are of solid concrete, no reinforcement being used. The piers are spaced 36 ft. centers. The dam is thus approximately 4,300 feet long from the power house to the opposite (Illinois) bank of the river.

An ice fender connects the power house with the west or Iowa side of the river. This structure is made up of a series of concrete slabs, 27 in number, each slab being 9 ft. wide, 15 ft. deep and 70 ft. long. These slabs are supported by piers, also of concrete. There is an opening in this ice fender 300 ft. in length which will be closed during the winter by a timber boom.

As already stated there are ten 10,000 h.p. generators already supplied, with five more being installed. Opposite each generator stands its corresponding 9,000 kv.a. transformer which steps the current up from the generated voltage of 11,000 to the transmission voltage of 110,000. Seventy-four 11,000 volt and twenty-one 110,000 volt oil switches have already been installed. Three large pressure filters have also been installed for filtering the water used in cooling the transformers. The high tension busses and connections are of 1¼ inch and 2 inch iron pipes supported by suspension type insulators.

Two views of the switchboard room are also shown. The switchboards consist of a main bench board for the control of generators, transformers and lines; a battery board; an auxiliary switchboard for the control of two exciter alternators; 15 small panels for the exciters; power switchboards controlling feeders to pumps, cranes, etc.; a lighting switchboard; and a mimic switchboard for the chief operator's use on which the position of all the main switches in the power station is indicated. These switchboards aggregate more than 200 ft. in length. The telephone system also requires two switchboards, one for commercial service, the other for the use of the chief dispatcher.

The 110,000 volt transmission line runs to St. Louis, a distance of 144 miles. The towers are four legged steel structures 79 ft. in total height, measuring 20 x 20 ft. at the base and weighing 6,800 pounds each. Each leg is bolted to a reinforced concrete foundation. The anchor towers are 74 ft. high, 24 x 24 ft. base and weigh 10,500 pounds. The towers carry a double 3-wire transmission circuit arranged in vertical planes 18 feet apart and at an elevation of 50, 60 and 70 feet above the ground. A ground wire for lightning protection purposes is strung along the apex. The wires on the main circuit are composed of 19 strands of hard drawn copper ⅝ inches in diameter and 300,000 c.m. in area. The ground wire is galvanized steel 7 strand cable, ½ inch in diameter.

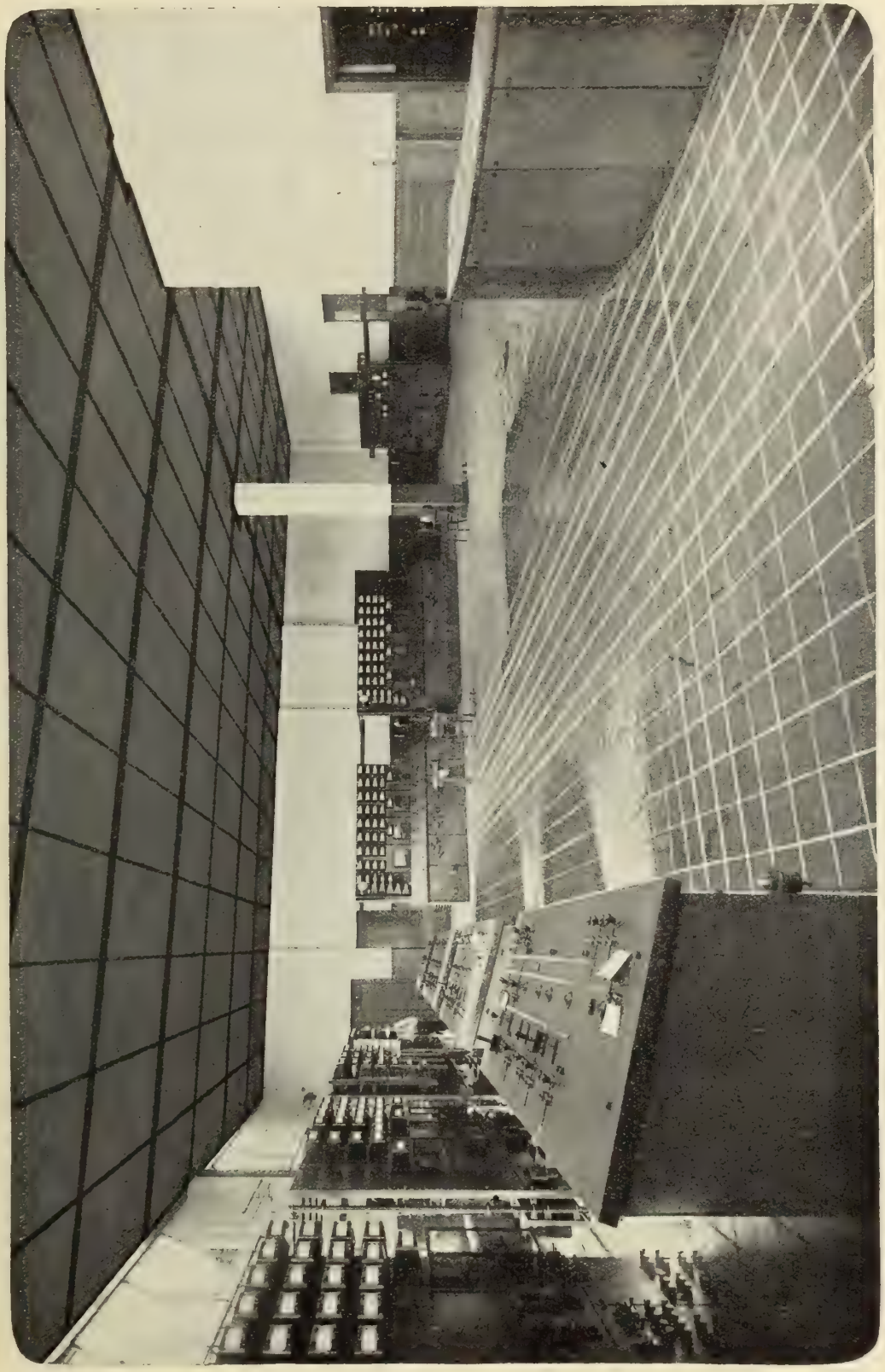
The insulators are of the suspension type consisting of 7 corrugated porcelain discs 10 inches in diameter connected by means of malleable iron fittings cemented to them. The complete insulator unit is 3 ft. in length. For river spans or special high strains insulators composed of 2 to 6 strings of standard units are used.

Branch lines at lower voltages are used to distribute a considerable quantity of the power. One branch operated at 11,000 volts supplies Keokuk and the surrounding towns. Another operated at 30,000 volts supplies about 18,000 h.p. to Hannibel and Quincy. A third operated at 66,000 volts supplies 12,000 h.p. to Alton.

Marconi Wireless

Progress is shown by the report for the year ending January, 1913, of the Marconi Wireless Telegraph Company of Canada, Limited, just issued. Under the new contract with the Canadian Government for the operation of wireless telegraph stations on the Great Lakes, four stations have been established and placed in operation during the past year; one station is at the present time being enlarged, and three other stations are to be built during the current year. The negotiations with the Newfoundland Government were brought to a satisfactory termination by completing a contract which will continue the company's exclusive rights in Newfoundland until the year 1925. Under the agreements with the Newfoundland and Canadian governments the following stations are operated:—ten stations for the Newfoundland Government, the controlling station of which, at Fogo, is the property of the company; twenty-two stations in Eastern Canada and Newfoundland for the Canadian Government, four of which are the property of the company; five stations in the Great Lakes, on behalf of the Canadian government. The number of steamers now operated by the company on its own behalf is forty-four, and in addition four steamers are operated on behalf of affiliated companies. As the old contracts for the equipment of steamships expire, they are being replaced, wherever possible, by new standard contracts, by means of which better conditions are secured to the company. The standard ship contract is for a term of five years.

The Trans-Atlantic station at Glace Bay has been operated by the company on its own behalf throughout the year, and recently the construction of the duplex receiving station at Louisburg and the construction of the six-wire pole-line connecting that station with the transmitting station at Glace Bay were completed. The duplex system will be put into operation as soon as its corresponding station, now in course of construction at Clifden, Ireland, has been completed. The directors report that contracts for the sale of apparatus for the equipment of a large number of ship and shore stations are in hand for the current year, all of which will show a satisfactory profit. During the recent session of Parliament the Canadian Government enacted a law making wireless equipment on passenger vessels plying in Canadian waters compulsory. This legislation, which becomes effective on January 1st, 1914, will result in further business for the company, owing to the necessity of equipping about fifteen additional steamers in Canadian territorial waters.



Mississippi River Power Plant, Keokuk, Iowa,—Main Switchboard Room



Mississippi River Power Plant, Keokuk, Iowa.—Main Switchboard Room.



Mississippi River Power Plant, Keokuk, Iowa—Generator room.

Value of Aluminium for Line Conductors

By Mr. E. V, Pannell*

The employment of aluminium wire and strand for overhead transmission has reached an advanced stage of development and the metal has undoubtedly shown that it possesses a wide field of application. The properties of aluminium as compared with copper are now thoroughly well known and it is therefore quite justifiable in a short article of this kind to consider the subject of aluminium "sui generis." Much has been written adopting a critical attitude towards the use of aluminium for overhead transmission in any form, but the experience of such important systems as the Pacific Gas and Electric Company, Pacific Light and Power Company, in California, Kiushiu Hydro-electric Company, Japan, Lake Coleridge Hydro-electric Development, New Zealand, Rjukanfos Company, in Norway, and many others, which have installed aluminium conductors quite recently, is sufficient to demonstrate that the matter is long out of the experimental stage. In all of the cases cited the engineers concerned made a careful study of the properties of the metal before installing it and to this their success is largely due.

In this country practically the whole of the aluminium in use for overhead work has a conductivity equal to 60 per cent. of the Matthiessen Standard for soft copper. This infers a purity of well over 99 per cent. and careful manufacture; both of these conditions are readily met by the producers to-day. In Europe, however, specifications commonly call for a conductivity of 60 per cent. of hard copper which is two per cent. lower than the American standard; it is therefore posible to use in Europe material which is considerably harder than that produced for users in this country. For instance a 14 gauge wire, drawn to a British or German specification, will probably give 29,000 lbs. per square inch on test, whereas it would be difficult to obtain more than 26,000 lbs. on the 60 per cent. conductivity basis. Special methods of rolling are necessary to get the required

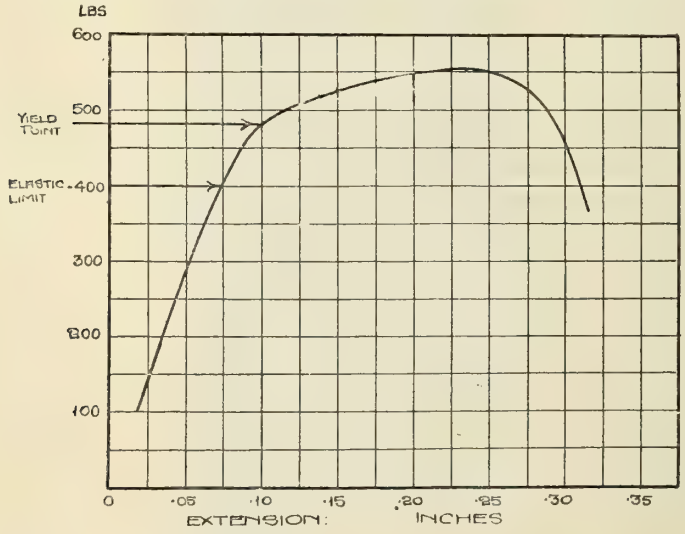


Fig. 1—Load-extension curve for aluminium wire size 24600 cir. mils

tenacity but this is a matter of very slight extra cost which in most circumstances would be well repaid in the improved physical characteristics of the transmission line.

The matter of the elastic limit or the yield-point is of considerably more importance than the ultimate strength and it is only the difficulty of measuring this quantity in a routine test which causes the ultimate strength to be specified in nearly every instance. With copper the ratio of elastic limit to ultimate strength is of the order of 50 per cent. to 60 per cent.; in the case of aluminium however the proportion varies according to the size of the wire from 40 per cent. to as high as 80 per cent. Taking the ordinary guages of wire commonly used in stranded cables the ratio is nearly always about 60 to 70 per cent. The permanent extension of an aluminium wire is from 2 to 3½ times the extension on copper. All of these factors tend to the advantage of aluminium when used as an overhead conductor and give it greater capacity for sustaining abnormal loads without fracture. The curve shown in Fig. 1 is due to Mr. B. Welbourn, of the British Insulated & Helsby Cables Limited, and shows at a glance the physical characteristics of a sample of aluminium wire as drawn to a European specification.

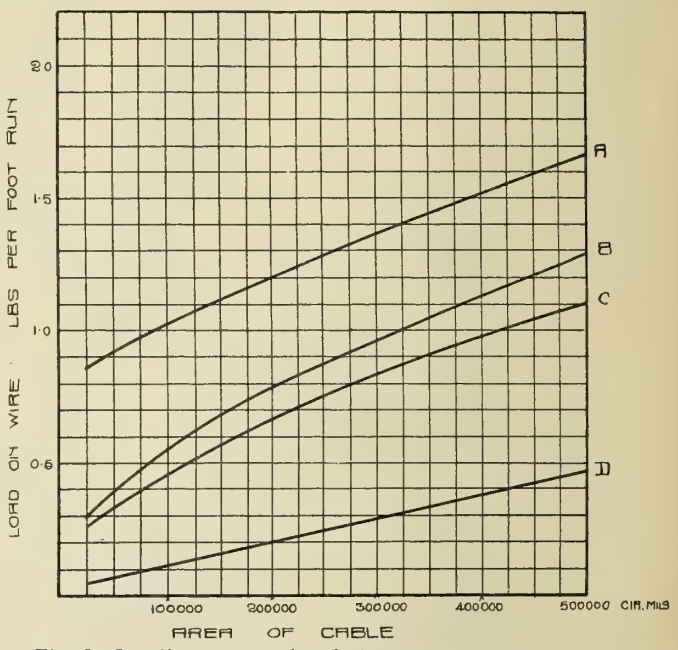


Fig. 2—Loading on overhead aluminium wires: A, With ½ in. ice coating and 65 mile wind; B, German Rules, (.127 + .84D); C, British Board of Trade Rules, 25 lbs. wind; D, Weight of wire alone.

The maximum permissable working stress in the wire is a subject which greatly influences the success attending the employment of any particular material as a line conductor. In Canada aluminium is usually strung so as to give a maximum working stress under the most severe winter conditions of just below the elastic limit. In Europe on the other hand where, as a rule, short distance pole lines predominate, the conductors are seldom strung to more than one-third or one-half the elastic limit. It is nowadays becoming recognised that a tightly strung line is better practice than one which is slack and that a long sag is likely to give much more trouble than a fairly high tension in the wire; this point is of so much importance that it is well worth sacrificing one or two per cent. on the conductivity if the tenacity of the wire and thereby the tension in the line can be safely increased. As already seen, on European specifications wire of 28,000 to 29,000 lbs. tensile can be employed; this could be produced with an elastic limit of about 18,000 lbs. and strung to take a maximum pull of 16,000 lbs. allowing ⅜ in. ice and a 65-mile wind with quite satisfactory results. The relatively short sag would allow of a short and sub-

* British Aluminium Company.

stantially designed tower of an economical type; the saving on the towers would more than pay for any small extra piece demanded for the special high tenacity material.

Below are tabulated the principal features of the aluminium cables supplied to an important hydro-electric undertaking in Sweden.

Area of cable, cir. mils.	318,000	321,000
No. of strands	19	37
Weight per foot, lbs.	.294	.298
Extension coeff. per degree F.	.0000119	.0000115
Specific resistance, microhms per cm^3. .	2.79	2.82
Resistance coeff. per cent. deg. F. .	.222	.222
Conductivity, per cent., Matthiessen standard	57.5	57.0
Breaking stres, cable, lbs. per sq. in.	25,600	31,200
Breaking stress, wire, lbs. per sq. in.	27,300	34,000
Elastic modulus, cable, lbs. per sq. in.	4,350,000	2,670,000
Elastic modulus, cable, lbs. per sq. in.	9,000,000	8,300,000
Extension on 5 in. length, per cent. ..	2.30	1.80

The above are test figures and are throughout somewhat better than the guarantees which were made upon this material. The cables were strung to give a maximum pull of 10,000 lbs. per square inch under severe wind and temperature conditions.

In Germany, where transmission lines are erected under the rules of the German Institute of Electrical Engineers aluminium cables have recently been the subject of considerable attention. The regulations just published make special provision for aluminium, calling for a maximum tension in the wires of 10,000 lbs. per sq. in., figured at 23 deg. with a wind and snow load equal to the expression .127 +

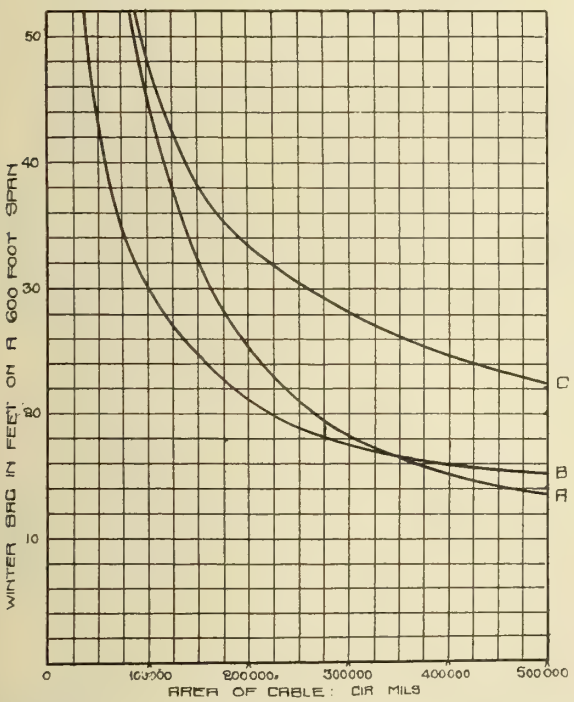


Fig. 3—Sag on overhead aluminium conductors under winter conditions: A, With ⅜ in. ice coating, 65 mile wind and 14000 lbs. per sq. in. maximum pull; B, German Rules (.127 + .84D), 10000 lbs. maximum pull; C, British Rules, 25. lbs. wind, 5600 lbs. maximum pull.

.84d lbs. per foot, where d represents the diameter of the cable in inches. This is a simple rule and is characteristic of the European method of reducing variable quantities to a formula wherever possible. As an interesting comparison the maximum permissible load per foot on overhead aluminium wires has been plotted out in Fig. 2 which shows the difference between American, German and British practice in this respect. In England no allowance is made for ice, but the relatively high value of 25 lbs. per square foot of plane surface (15 lbs. on the projected surface of the conductor) is taken for wind pressure. Regarding the vexed question of whether ice forms on aluminium it is generally agreed among European engineers that though ice may not form it is fairly certain that snow will cling to the wire and in some respects is more troublesome. A load of snow falling from an overhead conductor will release considerable of the tension on the latter causing it to snap upwards like a bowstring and possibly make contact with the wire above. In practice on several Norwegian lines it was found that neither ice nor snow gathered on the wires as long as the pressure was on, but only during a shut-down.

In Fig. 3 the sequel to the last diagram is shown, the sags under winter conditions being plotted for a 600-foot span (the most economical average length). In Great Britain as will be noted the rules are very conservative and this fact has prevented the development of overhead power in that country to any appreciable extent. The new German overhead line regulations however are much more liberal and it is interesting to observe the fact that for the most part the German engineers pull their aluminium lines up tighter than is customary in this country.

The foregoing remarks have expressed the desirability under certain conditions of utilising a special high grade of aluminium wire having extra high tenacity. Although this usually necessitates the reduction of 1 or 2 per cent. in the conductivity requirements this is a matter of far less moment and it would be well worth while for engineers when calling for tenders to give the manufacturer the option of putting in a material of superior physical characteristics but slightly higher resistance and to estimate what overall economy would be effected by the use of such metal.

Winnipeg's New Line

The type of transmission line recommended by the consulting engineers and which will be adopted by the Light and Power Department for the duplicate system is a combination of braced and flexible towers, with approximately twelve flexibles between each two, braced and spaced 400 feet apart, thus placing a braced tower at each mile. The type of tower to be used will not be decided upon until the tenders are in.

Tenderers will be asked to submit alternative bids and the type adopted will depend largely upon the result of specified tests. Tenders for the towers will not be called till spring but contractors will shortly be asked to tender upon the work of piling and other labor in connection with the preparation of the right of way. This tower line is to be erected along the right of way of the present 60,000 volt line which is approximately 75 miles long and will be designed to carry two 110,000-volt lines with suspension type insulators.

Personal

Mr. A. E. Grant, managing director of the Canadian British Insulated Company, Limited, Montreal, is on a visit to the West, going as far as Vancouver.

Mr. J. H. Bunting, joint manager of Bruce, Peebles & Company, electrical engineers, Scotland, has been on a short business visit to Montreal, returning home via New York.

M. J. F. Madden, manager of the Winnipeg branch of the Canadian General Electric Company, recently sustained a compound fracture to the right leg in an automobile accident.

Mr. Geo. D. Leacock, Canadian Moloney Electric Company, Toronto, will be married on November 20th, in Bloor Street Presbyterian Church, to Miss F. O. Powis, also of Toronto.

Testing of Telephone and Telegraph Lines

By Mr. T. H. Nicholson

The Voltmeter Shunt Coil

It often happens that the resistance of a voltmeter is not given in round numbers and as a result it is difficult to use the above formula mentally. For this reason as well as for others explained later, a shunt coil is used to reduce the resistance of the measuring equipment to a figure easily calculated. This does not affect the tests, or the accuracy of them, providing the testing battery is adjusted to give a full scale deflection on short circuits, with the shunt coil in use, in a manner exactly similar to that followed with an unshunted voltmeter.

For example, Fig. 12 shows a voltmeter having a resistance of 1655 ohms; as such a number is cumbersome in making calculations it simplifies matters materially if we reduce this resistance to 1000 ohms by the insertion of a parallel or shunt resistance, X. The value of X is obtained from the standard formula

$$\frac{1}{1000} = \frac{1}{1655} + \frac{1}{X}$$

from which X works out to approximately 2527 ohms, which number is close enough for practical purposes.

We now have a voltmeter arrangement which for all practical purposes is similar to a voltmeter having an internal resistance of 1000 ohms as shown in Figs. 10 and 11. The value of the external resistance A is therefore found from the formula already given

$$A = \frac{D}{d} - V - V$$

$$= \frac{D}{d} - 1000 - 1000$$

Where D and d are, as before, the needle deflections, respectively, before and after the external resistance A is inserted. This formula is perhaps more easily carried in the

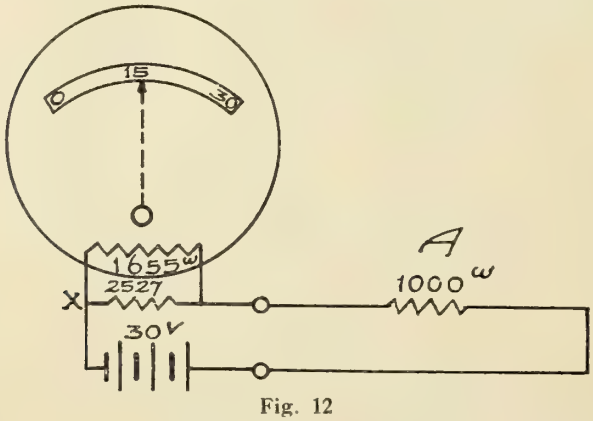


Fig. 12

form (D/d — 1) 1000 and may be conveniently explained as follows:—divide the voltmeter scale by the deflection, subtract one, and multiply by 1000.

Some wire chiefs like to be able to measure resistance smaller than can be determined with accuracy with a 1000 ohm voltmeter and for this purpose use a 100 ohm arrangement. This is accomplished in the same manner as with the 1000 ohm circuit and, if so desired, a voltmeter can be arranged for use with either. The method adopted is shown in Fig. 13, where the same voltmeter as shown in Fig. 12 is assumed only, in addition to the 2527 ohm shunt coil X, an additional coil Y is provided and adjusted to give, with the voltmeter resistance of 1655 ohms, a joint resistance of 100 ohms. In this case Y works out to approximately 106 ohms. Where the resistance A is very small, as shown in Fig. 13, the deflection of the needle, using the 1000 ohm circuit, would be somewhere between 29 and 30, but its position would be difficult to determine accurately. If its position were taken as 29 the value of A would work out about 34. With the 100 ohm circuit, however, the deflection would be exactly 29 and the resistance would work out at 3.4 ohms.

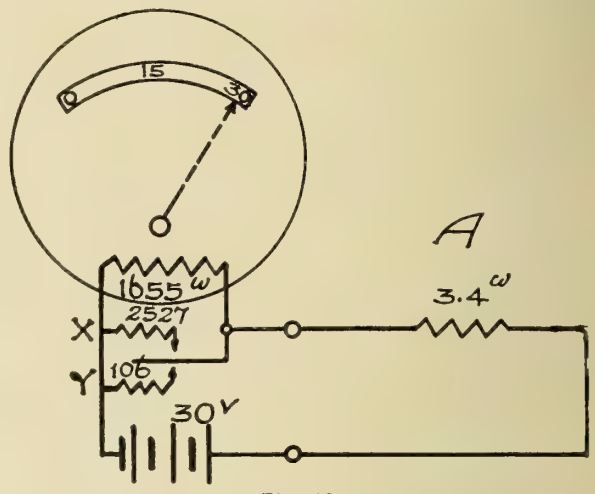


Fig. 13

These points amphasize the fact that this type of instrument has its limitations where the resistance to be measured are small.

Care must be taken with the use of a 100 ohm shunt, or for that matter with any shunt, to avoid keeping it in circuit any longer than is absolutely necessary to observe the deflection. This is for the reason that it will run down the testing battery rapidly, and so make the results misleading. Then again, it must be remembered that a greater voltage is sent out on the line when a shunt coil is in use, so care is necessary to avoid giving trouble-men disagreeable shocks.

Another valuable feature of the shunt coil is to give uniform readings on all of a group of voltmeters on a large test board, so that a tester will know that each instrument will indicate the same whether it is his own position or not, This makes it possible to have a table made up for common use showing the various reading values for any shunt that the voltmeters are equipped with. The following table gives the resistances as indicated on any 30 volt instrument using a 1000 ohm circuit as shown in Fig. 12:—

Tables of resistances as indicated by a 30 voltmeter, using a shunt coil giving 1000 ohm circuit.

D	R	D	R	D	R
1	29,000	11	1,727	21	428.6
2	14,000	12	1,500	22	363.6
3	9,000	13	1,308	23	304.3
4	6,500	14	1,143	24	250
5	5,000	15	1,000	25	200
6	4,000	16	875	26	154
7	3,286	17	764.7	27	111
8	2,750	18	666.7	28	71.1
9	2,333	19	578.9	29	34.5
10	2,000	20	500	30	0

D = deflection. R = resistance indicated.

(To be continued)

Electric Railways

Street Railway Depreciation

The printed report on the valuation of the Toronto Railway Company's system contains some interesting figures with regard to depreciation of the various equipments. While this is not given in detail in certain instances, definite figures are given however of the electrical distribution system and of the power plant equipment. The figures given under these two headings are as follows:—

Electrical Distribution System

	Years' Life	Depreciation Per Year
Iron poles	35-40	3 to 2½
Cedar poles	20	5
Pole brackets	25	4
Cross arms—wood	20	5
Cross arms—iron	30	3 1-3
Weatherproof cables	30	3 1-3
Lead cables	35	3
Transmission line material	20	5

The depreciation of the power plant equipment was based both on the number of years the equipment had been installed and the manner in which it had been maintained. The rates of depreciation generally applied are enumerated below:—

Power Plant Equipment

Machinery foundations:

These are depreciated at the same rate as the machinery which they support.

Coal handling apparatus ... 6 per cent.

Grates and stokers:

Maximum ... 50 per cent.

This item is depreciated 10 per cent. per year for 5 years, and no further depreciation is applied if they are in use.

Boilers and settings:

Horizontal tubular boilers	8	per cent.
Water tubular boilers	3½	per cent.
Steel smoke breeching	10	per cent.

Stacks:

Brick and concrete	3	per cent.

Heaters:

Open heaters	3	per cent.
Closed heaters	6	per cent.
Closed cast iron heaters	4	per cent.
Pumps	5	per cent.
Air compressors	5	per cent.

Engines:

Corliss, slow speed	3	per cent.
Automatic, high speed	5 to 8	per cent.
Piping and covering	3½	per cent.

Generators and transformers:

Slow speed	4	per cent.
High speed	5	per cent.
Transformers	5	per cent.
Rotary converters	5	per cent.
Switchboards, generator leads and wiring	3	per cent.

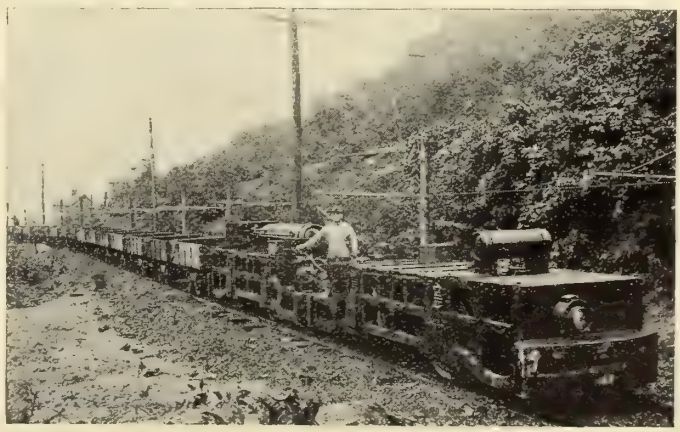
The substructure of the track was depreciated on a basis of 4 per cent. per annum. The life of the rail itself was considered to be the period of time required for the head of the rail to wear away to a remaining height of 5/8 inches above the tram or the base of the groove, the difference between this height and the height of the head above the tram at any time constituting the remaining wearing life of the rail. Measurements were taken at frequent intervals along the track with a specially constructed vernier measuring device, by which means the actual distance between the head of the rail and the tram was obtained in 64ths of an inch. From this determined height there was deducted the scrap height of 40-64 inches, the remainder representing the wearing height of the rail.

Car bodies in all cases were depreciated according to a life of 20 years for continuous service or, with a partial steel under-frame, a life of 25 years. The life of car bodies used only during summer and winter was taken as 25 years. The truck and motor equipment were depreciated by inspection.

The Largest Mine Locomotive Ever Built

The Carnegie Coal Company have recently installed at the Charleroi (Pa.) Coal Works two of the largest mine locomotives ever built. These locomotives weigh 30 tons apiece and are of the Baldwin-Westinghouse "Barsteel" type. It is estimated that each locomotive can haul 100 cars each loaded with three tons of coal over the local grades.

The reasons for using such large locomotives are as follows:—the Carnegie Company recently acquired posses-



Two 15-ton locomotives operated in tandem

sion of the Charleroi mine, which is of considerable size and is well developed. A large production is desired from it but the haul is about two miles long with the grade largely against the load. Hence the average haulage locomotive of from 15 to 25 tons would not be sufficiently large to keep production up to the estimated tonnage.

The locomotives installed possesses a number of interesting features. Each locomotive consists of two separate

units which can be separated and used as two 15-ton locomotives if desired. This use of two units in tandem is advantageous in such large machines because the weight is distributed over eight wheels instead of four and hence the locomotive has great tractive power and is also easier on the track than if the weight were more concentrated.

The "barsteel" construction represents the most modern type of design. As is clearly seen in the illustrations, the frames are not built up of plates but are formed of a grid of steel bars of heavy cross-section. The side frame of each unit is cast separately forming an extremely strong and rigid construction. The openings in the frame give ready access for inspecting, oiling, replacing brake shoes, adjusting brake rigging, etc., and also provide thorough ventilation to the electrical apparatus so that its all-day efficiency is higher than would be the case if the frame were totally enclosing. This type of frame has been in use for many years for large freight locomotives but has been only recently adapted for mine locomotives.

Air brakes are used owing to the greater ease of handling so large an engine but each unit is equipped with hand brakes which can be operated together from the operating stand of the leading unit. An auxiliary reservoir is provided on the trailing unit, the main reservoir and compressor being located on the leading unit. The hand brakes are operative on both units when disconnected for independent operation. The controller for the tandem is of the individual magnetic blowout type and handles all four motors at once. When the tandem is split, the four-motor controller handles the two motors of its unit without change in connections while the other unit has its own two-motor controller.

New Cars for Montreal Tramways

As already noted in these columns the Montreal Street Railway Company will shortly place in operation 25 motor cars and 25 trailers for train operation on St. Catherine Street, Montreal. The cars are being supplied by the J. G. Brill Company. St. Catherine street is the trunk line of the Montreal system and conditions for train operation are favorable in-as-much as the traffic is generally heavy enough to justify operating two-car trains throughout the whole day. Hence neither the time lost in making up trains nor low trailer mileage will enter into the question.

It was pointed out in our previous issue that one of the important operating features of the new service will be that all of the loading and most of the unloading will take place at the centre of the train. This is accomplished by constructing the trailer with entrance and exit both at the front end only. These two-car trains will practically constitute an articulated unit with two entrances and two exits at the centre of the train and one exit at the front end of the motor car.

The new motor car will have longitudinal seats in the half which is nearest the loading platform. The vestibule closing with folding doors will make it possible to do away with all body doors and all end bulkheads. Folding steps will also be used in connection with the doors. The seating plan and the door and step arrangement of the trailer are similar to those of the motor car as shown in the figure herewith, except that the trailer is provided with circular seat at the rear. The rear platform of the motor car and the front platform of the trailer are practically duplicates in the arrangement of the dividing rail, conductor's stand, aisle widths etc. The platforms are 5 feet 9 inches long. It will be observed that means for both exit and entrance are provided on the loading platforms in addition to the customary sliding door exit on the motorman's platform. An important feature will be the wiring of all doors in series so that the motorman will not receive the light signal for starting until every door in the car is closed.

Each motor car will be equipped with four 50 h.p. motors, commutating pole type. The trucks will have 30-inch diameter wheels with step heights as follows:—from ground to first step 16 inches, from first step to platform 12 inches and from platform to car floor 8 inches.

Steel Gas-Electric Motor Cars

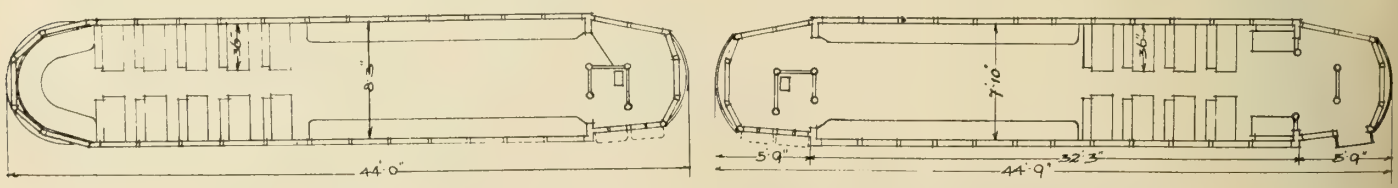
One of three gas-electric motor cars, built by the Wason Manufacturing Company for the Midland Valley Railroad Company, has recently been placed in operation for supplementary service on the company's main line between Wichita and Arkansas City, Kansas. The railroad's complete system extends from Wichita through Muskogee, Oklahoma, to Hoye, Arkansas, and, including numerous branches, embraces a total of 365 miles. The new car makes one round trip a day over a distance of 102 miles at a scheduled speed of 18.5 miles an hour.

The cars have all-steel frames, consisting of I-beams and channels, with side sheathing of steel plates. The underfloor is of wood with heavy felt lining between it and the car floor. There is also a felt interlining to the car sides. On either side of the centre, separating the passenger and smoking compartments, is an entrance with three inside steps leading to the car floor. There is also an entrance at the rear leading from the open platform.

The cars are of the General Electric Company's standard combination passenger, smoking and baggage compartment type, and are handsomely finished in mahogany, with plate glass windows. The transverse seats are of sufficient length to accommodate three persons and are upholstered with plush in the passenger compartment and with Spanish leather in the smoking room. The total seating capacity is 86 persons.

The generating unit consists of an eight-cylinder, four-cycle gas engine, direct connected to a 600-volt commutating pole electric generator designed to meet the special conditions demanded by the service. The engine is started by compressed air from the main reservoirs of the air brake system, which are built with surplus capacity for this purpose. The engine can rotate at normal speed and deliver its maximum power irrespective of the speed of the car, which is of great advantage on grades and in emergencies. There is also an auxiliary equipment consisting of a two-cylinder, four-cycle gas engine, direct connected to a single-cylinder air compressor and lighting generator. Two 600-volt railway motors of 100 horse-power each are mounted on the axle of the forward truck.

The Steel City Electric Company, Pittsburgh, announce the appointment of the Ohio Distributing Company, Hearst Building, Chicago, as their sales representative in the Central Western States, effective November 1st, their previous contract with the I. A. Bennett Company having expired.



Sectional plan of one of 25 new cars to be operated by the Montreal Tramways Co.

Use of Higher D. C. Voltages

By Mr. G. H. Hill*

The fact that 1,200 volts and higher direct current potentials are used on more than nineteen hundred miles of electric roalroads in this country, furnishes in itself convincing evidence of the success of this application with respect to initial cost, reliability and low costs of maintenance.

Several years of operation has fully demonstrated the ability of the apparatus to withstand the most severe service without "nursing," and with most satisfactory economic results. In fact results have surpassed expectations in many respects, and it is conservative to state that 1200 volt apparatus costs no more to operate than 600 volt apparatus.

Reports of remarkable endurance and reliability, including every feature from power house to rolling stock, have been the rule. Coming from unprejudiced, practical operators and supported by a formidable array of statistics there is no room for skepticism. Records show that with 90 per cent. of the available equipment in hard and continuous service, cars have averaged over 250,000 miles without renewing any motor brushes or bearings, control contacts, or similar parts. The generating apparatus has run continuously for months without interruptions or renewals of parts, and has endured heavy overloads for long periods without distress. Inspection and maintenance crews have been reduced to a minimum unusual with even the best known practice.

To those who are not familiar with the details of the apparatus used with the higher voltages these results undoubtedly appear remarkable, since we are accustomed to expect a period of development, and more or less experimenting, with new methods and systems.

The idea that the application of higher d.c. voltages constitutes a "system" differing from 600 volts was perhaps natural, inasmuch as the initial application came at a time when much was being said about "systems," the single-phase system especially being much discussed.

No New System Involved

Properly considered, the use of the higher d.c. voltages does not involve a new "system." It is simply a logical advance along established lines, wherein not a single good element is discarded or replaced. The necessity for a higher distribution voltage than 600 was generally recognized as soon as electric interurban and heavy freight railways became economically possible. The operating voltage had been increased from 500 to 600 and 700 volts in many instances, and the increase to 1200 was a natural step as soon as the improvements in generators, motors and control apparatus made this commercially possible. The one improvement that permitted this step in advance was the successful application of the old idea of commutating poles to motors and generators. With a full understanding of the commutation problem, the proper application of an intermediate flux to neutralize armature reaction removed the chief limitation in electrical design, and made the problem of higher voltage one of insulation and the perfection of auxiliary details.

A short experience with 1200 volt apparatus indicated the feasibility of still higher potentials and led at once to the use of 1500 and 2400 volts, where such voltages were economically desirable. By regarding these higher voltages for railways as the natural development and extension of the existing standard system, unnecessary mystery and incredulity attendant on new systems disappears.

A brief analysis of the elements of 1200, 1500 and 2400 volt apparatus will support this point of view by exhibiting their simplicity and the absence of untried or doubtful features, and may as well be of interest as indicating the solutions of some of the attendant detail problems.

With any d.c. voltage the usual and desirable three-phase generation and transmission are applicable, so this need not be considered when making comparison with 600 volts. The great importance of a balanced polyphase transmission, capable of tying in with any standard power system and free from disturbing inductive influence on other neighboring circuits, is being more and more recognized and can not be over estimated. The elements more or less affected by the higher voltages are the substation apparatus, the distribution conductors and the rolling stock.

The conversion of alternating current to direct current may be made, as with 600 volts, by rotary converters or motor-generator sets. With 25 cycle transmission it is usual to employ rotary converters for 1200 or 1500 volts. These may be single units where there is no need for power at half voltage. Where such half voltage is desired for city running or to supply existing equipment, two converters are connected in series.

Single unit converters of 1200 or 1500 volts are provided with commutating poles to neutralize armature reaction and provide good commutation with the necessarily increased volts per bar, as compared with 600 volt machines. They are started from the a.c. side by ½ or 2-3 voltage taps as usual. The use of commutating poles makes it desirable to lift the brushes from the commutators during the starting period to avoid the sparking set up by the leakage flux through the unexcited commutating poles. By a simple mechanical arrangement all brushes but two are raised by a single lever, and a semaphore at the top of the field frame is lifted to clearly indicate the fact to the switchboard attendant. The two brushes not lifted are special narrow pilot-brushes and are left in contact to excite the shunt fields. The use of commutating poles on converters gave such satisfactory results that they have been introduced on all large 600 volt machines, and are being applied in numerous cases to small 600 volt units. Likewise the brush lifting device has been received as an inherent improvement, quite aside from the initial purpose, and has created a general demand for such an arrangement on account of the convenience it affords in caring for the commutator.

Where 60 cycle transmission is employed, two converters in series may be used for 1200 volts.

High voltage generators reliable

The inherent limitations of design, namely, volts per bar, peripheral speed of commutator, and permissible minimum width of bar, combine to place the limit of possible voltage at about this point. Sixty cycle transmissions are frequently extensive and contain a large proportion of inductive load. For this reason the more stable synchronous motor-generator set is usually employed, especially when control of power-factor is a desideratum. The generator of such a set, wound for 1200 or 1500 volts, with a single commutator, is similar to a 600 volt generator with the addition of a compensating winding as well as the commutating poles. This compensating winding consists of a number of series turns through the face of the exciting field pole, to supplement the action of the commutating poles and completely neutralize the armature reaction. Such machines properly designed are fully equal to the best 600 volt designs as to commutation and reliability, and are superior to them in ability to handle heavy overloads.

For 2400 volts the three unit set is employed, having two 1200 volt generators connected in series and driven by a single synchronous motor. For the excitation of the synchronous motor a direct current exciter of low voltage is usually directly connected to the set. It is economical in space and cost to supply the shunt field of the generator also from this exciter, although, if wide control of power-

* Elec. Ry. Dept. General Electric Co.

factor on the synchronous motor is desired, it is better to have two direct connected exciters, one for the motor and one for the generators.

The transformers which supply the rotary converters or motor-generator sets have practically no features different from the standard low voltage apparatus. The secondary voltage is approximately double for a single unit, or two secondary windings are provided, each giving half voltage where two converters are connected in series.

The switchboard for the a-c. circuits does not differ from low voltage apparatus. For the direct current panels the difference consists in improved circuit breakers for handling the higher voltage arcs, and in isolating these devices more effectually and insulating all live parts from contact with the operator. The circuit breaker and main switch for 1200 and 1500 volts are placed high on the panel and connected to operating handles by wooden rods at the back of the panel. For 2400 volts these parts are separately mounted over, and back of, the panel.

The meters, voltmeter jacks and all live parts are thoroughly covered and insulated. As an additional precaution against leakage currents through any metallic seams that may be in the slate, all conductors which pass through the panel are bushed with porcelain.

Distribution Conductors

The trolley and distribution feeders differ only in the use of somewhat better insulation. The introduction of wooden strain insulators in cross-spans, guys and pulloffs, in addition to the standard 600 volt appliances, has been found ample. Incidental with the development of heavy interurban projects and heavy freight electrifications made feasible by the higher voltages, marked improvements have been made in the trolley construction. The ordinary direct suspended trolley wire and wheel collector are unsuited to heavy and fast traffic, because of:

First. Insufficient resilience due to the rigidity of the wire supports and the inertia of the trolley wheel.

Second. Insufficient collecting capacity.

Third. Inconvenience of reversing the trolley pole and keeping it on the wire.

These are overcome by use of the catenary suspension with hangers permitting a vertical movement of the conductor and the elimination of all heavy fittings at crossovers, switches, etc. This produces a perfectly flexible conductor free at all points to yield to the upward pressure of the collector, and effectually solves the problem of high speed operation, at the same time permitting the use of a heavier collector with greater upward pressure. Instead of a trolley pole and wheel a pantograph with wide roller is used, which may be run in either direction and raised or lowered pneumatically by the motorman. This combination can successfully collect from two to three times as much current as the older types, and is suitable for the heaviest freight or highest speed passenger locomotive.

Third rail collection on 1200 volts has been in successful operation for several years, and has been found entirely feasible in test for 2400 volts. The under running type of rail is used, the rail being smaller and the insulators larger than for 600 volts. Wooden protection over the rail is provided and is effectually insulated from the rail by porcelain supports.

Rolling Stock

The series-parallel connection of motors with or without field weakening is used as with 600 volts. For operation on a 1200 volt line the motors may be wound for 600 volts each, and insulated for 1200, or may be wound and insulated for 1200 volts. The first arrangement permits operation on 600 volt connecting lines at full speed; the second provides series-parallel control with two motor equipments. It is not economical in design to build motors for 1200 volts each smaller than about 125 h.p., and as most interurban road operators prefer four motor equipments requiring not over 100 h.p. per motor, the usual selection is the first alternative. For 2400 volt lines the motors are wound for 1200. As 2400 volt installations chiefly require haulage by locomotive and a limited number of heavy passenger cars, the motors are large enough for economical design at this voltage. In every case the motors lend themselves mechanically and electrically to the best modern practice. Low armature speeds, large air gap, ample bearing surfaces, full ventilation with self-contained fan, heat proof insulation, and all the other well-known desirable features of the perfected railway motor are embodied in the high voltage designs. Likewise the control retains its simple rugged contactor with improved magnetic blowout and insulation. The contactors are assembled in sheet iron boxes which are thoroughly grounded as with the lower voltages. The secondary circuits are the same as for 600 volts and are operated direct from the trolley when the car is on a division with this voltage. When on the high voltage trolley the control current is derived from a small auxiliary dynamotor or motor-generator set.

For 1200 or 1500 volt motor cars the dynamotor is used, it is lighter and more compact. This rynamotor consists of an armature with double windings and two commutators with a single field. The two armature windings are in series across the line, and the half voltage for the auxiliary circuits is obtained from a tap between the armatures. The device is simple and reliable, and requires little attention. The bearings have light duty, as there is practically no mechanical torque on the shaft.

The master controller, control couplers and jumpers are exactly the same for the high voltage as for the low, and the control can be made for automatic or hand control as desired.

For the smaller size of 1200 or 1500 volt equipments the ordinary platform controller can be provided. This makes available the very simplest form of equipment. These cylinder controllers are built along the same line as for 600 volts, but with the improved magnetic blowout and with greater space and insulation for the isolation of the arcs. The insulation in the controller is made ample so that the frame of the controller may be grounded, which is the only thorough manner of protecting the motorman. For locomotives, the Type M control is used, and instead of the dynamotor a small generator provides current for the auxiliary circuits at low voltage. This small generator is driven by the same motor that drives the ventilating fan. As a ventilating fan is always furnished with the locomotive, in order to give the locomotive motors the highest possible continuous rating, the addition of a small generator adds practically no complications.

Auxiliary Circuits

The auxiliary circuits outside of the control, viz., air compressor motor, the lights for motor cars, and the heaters for motor cars and locomotives, required more or less special development. The simplest arrangement, which was adopted on the first high voltage cars, was the use of standard 600 volt lights, car heaters and air compressors supplied with low voltage current from the dynamotor. This, however, makes the dynamotor of considerably greater capacity and weight, and is, from an engineering point of view, unnecessarily indirect. The design of 1200 volt car heaters was not a serious matter, it being necessary chiefly to provide against foreign objects coming in contact with the live parts, and at the same time not restrict the free circulation of air. Various plans have been suggested and tried for the air compressor. One method is to connect a 600 volt compressor across the high armature of the dynamotor and the other auxiliaries across the low dynamotor armature. This tends

to reduce the required size of the dynamotor, and if the loads on the high and low circuits are fairly well balanced, is a satisfactory arrangement. Another scheme provided for a combination dynamotor-compressor in which the dynamotor was connected to the air compressor by a clutch. The disadvantage of this is the inherent unsuitability of the dynamotor to do mechanical work. When acting as a dynamotor there is no torque on the shafts and no armature reaction, but when it is coupled to the compressor, and is called upon to do mechanical work through the shaft, the device becomes more motor than generator, and the result of armature reaction causes sparking at the brushes. This cannot be corrected properly in the designing, since the same armature may be called upon to be a generator at one time and a motor at another. The most satisfactory arrangement for the air compressor is to keep it independent of other curcuits and provide it with a high voltage motor. It is found that a 1200 volt motor of this size can be built with very excellent characteristics. A very satisfactory arrangement consists in having two motors on the compressor, one on each side. On 1200 volts these two motors are connected in parallel and for 2400 volts they are connected in series. If the equipment is to operate on 600 and 1200 volts, the two small motors are each wound for 600 volts, so that full compressor speed may be obtained both on high and low voltage.

In many cases the amount of current required for car lighting is small enough to make it desirable to supply the lights from the dynamotor, but if there are a large number of lights, and if a large headlight is desired, it is desirable to remove these circuits from the dynamotor. Experiments show that it is not safe to connect a sufficient number of the ordinary car lights in series across 1200 volts. The reason for this is that the contacts and leading-in wires of the sockets on the standard 600 volt lamp are close enough together so that the breaking of a filament in one lamp on the 1200 volt circuit might hold the arc across the leading-in wires of the lamp, which would continue to burn until it destroyed the lamp base and socket, and this might possibly become a fire menace. Accordingly a new design of socket and lamp was necessary. This has been produced, and is somewhat similar to the parts used for series street lighting. With this new socket either six 200-volt lamps or twelve 100-volt lamps may be used in series. The lamps and lamp sockets are installed in iron receptacles and the wiring is placed in iron conduit. The receptacle for the socket is designed to cover the lamp base and all live parts and is thoroughly grounded. This gives very thorough protection to persons handling the lamps. The switches for the heater circuits and for the lamp circuits are thoroughly enclosed and protected. The usual arc headlight on 1200 volts necessitates consuming a large amount of energy in resistance. Experiments with incandescent lamp headlights have shown that, with a properly made parabolic reflector, a lamp with a small centralized filament, which can be accurately focused in the reflector, makes a very excellent headlight and is much more economical than the arc headlight. This incandescent headlight may be placed in series with the car lights or even in series with a certain amount of resistance, as the high efficiency tungsten filament is used and the current is much less than for the arc light.

The lights for locomotives on either 1200 or 2400 volts require but little energy and this is best furnished from the low voltage generator.

Car equipments for 2400 volts are provided with a small motor-generator set to supply the low voltage auxiliary circuits. In some instances on either 600, 1200 or 2400 volts, operators have considered the lighting question important enough to warrant an arrangement which will provide very steady voltage on the lighting circuit, and also one that will

Lines in the United States using 1200 volts and upwards

ROAD	Permanent Way Length of Route	Overhead Construction Trolley or Third Rail Type	Volt-age	Transmission Line Volt-age	Fre-quency	Phases
India'napolis & Louisville Traction Ry. Co., Scottsburg, Ind.	41	Direct Suspension	1200	.....	..	3
Central California Traction Co., Stockton, California.	69	Catenary and Third Rail	1200	60000	60	3
Pittsburg, Harmony, Butler & New Castle Ry., Eidenau, Pa.	65	Direct Sus., Double Trolley	1200	13200	60	3
Washington, Baltimore & Annapolis Elect. Ry., Baltimore, Md	60.6	11 Point Catenary	1300	33000	25	3
Milwaukee Electric Wailway & Light Co., Milwaukee, Wis..	135	Catenary	1200	13200 38000	25	3
Aroostook Valley Railway Company, Presque Isle, Me.	32	Direct Suspension	1200	11000	60	3
Oakland, Antioch & Eastern Ry., San Francisco, Cal.	100	Catenary	1200	11000	60	3
Southern Cambria Railway Company, Johnstown, Pa.	23	Direct Sus., Dougle Trolley	1200	.....	..	
Shore Line Electric Railway Company, Saybrook, Conn.	74	Bracket Catenary	1200	11000	25	3
Southern Pacific (Oakland, Alameda & Berkeley Div.), Cal.	81	Catenary	1200	13200	25	3
Ft. Dodge, Des Moines & Southern Railway, Boone, Iowa.	120	Direct Suspension	1200	22000	25	3
Southwestern Traction & Power Co., New Iberia, La.	12.5	Catenary	1200	.....	..	
Oregon Electric Railway, Portland, Oregon	154	Catenary	1200	60000	33	3
Davenport & Muscatine Railway Co., Davenport, Ia.	30	Catenary	1200	33000 Y	60	3
Kansas City, Clay County & St. Joseph Ry., Kansas City, Mo.	72	Catenary	1200	33000	25	3
Nashville, Gallatin Interurban Railway, Nashville, Tenn.	27	Direct Suspension	1200	33000 Y	25	3
Piedmont Traction Company (Couth Pr. Co.), Charlotte, N.C.	130	Catenary	1500	100000 and 50000	60	3
Butte, Anaconda & Pacific Railway, Butte, Mont.	30	Catenary	2400	.....	..	
United Railway Company, Portland, Oregon	28	Catenary	1200	60000	33	3
Southern Traction Company, Dallas, Texas	158	11 Point Catenary	1200	33000	60	3
Pittsburg & Butler Railway Company, Pittsburg, Pa.	33	Catenary	1200	22000	25	3
Pacific Elect. (San Bernardino Div.), Los Angeles, Cal.	57	Catenary	1200	60000	50	3
Tidewater Southern R.R., Stockton, Cal.	40	Catenary	1200	104000	60	3
Portland, Eugene & Eastern Railway Co., Portland, Oregon.	95	Catenary	1500	13200	60	3
Southern Illinois Railway & Power Co., Harrisburg, Ill.	17	5 Point Catenary	1200	33000	60	3
Jefferson County Traction Company (Eastern Texas Electric Co. S. & W.), Beaumont, Texas	20	Catenary	1200	.....	..	
St. Paul Southern Electric Railway, St. Paul, Minn.	18	Catenary	1200	33000	60	3
Michigan United Traction Company, Jackson, Mich.	92 150	Third Rail and Direct Suspen. Trolley	2400 1200	140000 40000	30 60	3 3

provide lights in case power is cut off at crossings or for any other reason. Such an arrangement consists of a storage battery with small motor-generator, the motor being fed from the line and the generator floating across the storage battery. When this arrangement is used the lights are usually wired on 125 volt circuit.

For lighting waiting rooms along the railroad on 1200 or 1500 volts, series lamps fed from the trolley are used. For voltages of 2400 or higher it is desirable to feed such lighting circuits separately from the a-c. transmission.

Higher voltage direct current for railways is not to be considered as superseding 600 volts. The voltage to be used in any case depends upon the character of the service and the conditions to be met. For congested service having a large number of small equipments the 600 volt system is undoubtedly the most economical in every way. For interurban lines having heavier equipment operating on longer headway, and with light freight service, 1200 or 1500 volts is most economical, while for heavy trunk line electrification 2400 volts is required. There undoubtedly will be cases where higher potentials than 2400 volts will be advantageous, and there is no reason why apparatus cannot be designed for higher direct current potentials than 2400 volts. In fact, it seems entirely feasible to carry this development successfully to say 5000 volts. This voltage will undoubtedly take care of any train movement that exists on even the heaviest grade sections of trunk railways.

Electric Brakes

One of the requirements of heavy grade work is a means for electrically braking the train, and this ability has been one of the principal advantages of the polyphase a-c. system. It has been found, however, that the direct current locomotive can be provided with regenerative control which is very simple, feasible and practical. The addition of this valuable element to the direct current locomotive places the direct current system in the enviable position of meeting all conditions with apparatus throughout of well-known characteristics and thoroughly established reliability and practicability. It contains no elements which are objectionable from an operating point of view, and provides all of the flexibility that can be desired for meeting different situations.

As opposed to the direct current system, the single-phase system with commutator motors has the objectionable feature of heavy motors with poor electrical constants and high maintenance costs, while the split phase system using polyphase motors introduces the untried feature of the phase converter, and both these a.c. systems have the objectionable inductive disturbances of the single-phase trolley and transmission. The straight three-phase locomotive is hampered by the double overhead trolley which resists its use to special situations.

The list herewith of lines in the United States will indicate the widespread interest being shown in high voltage operation. This list is taken from a recent paper by Mr. John A. Dewhurst, of the General Electric Company.

The Sherbrooke Railway & Power Company

The gross earnings of the Sherbrooke Railway & Power Company for the three months ending September 30th, 1913, amounted to $39,594, an increase of 18.5 per cent. over the same period in 1912. Operating expenses increased at a slightly higher rate namely 20.1 per cent., but the increase in net is still 16.3 per cent. Earnings will be further enhanced by the power contracts with the Canadian Brakeshoe Company amounting to 700 h.p., the Canadian Connecticut Cotton Mills 500 h.p., and the Panther Rubber Company 150 h.p. It is also expected that smaller contracts will total another 150 h.p. These will in all probability be in operation within the next six months.

Miscellaneous

The Danforth avenue extension of the Toronto municipal railway system was opened for service on October 30th. This line will operate ten new cars.

It is reported that The Hamilton Incline Railway Company will expend $200,000 on the installation of a 1000-foot incline railway, lifting a distance of 319 feet.

Of the five radial railway schemes suggested in connection with the Whitby and Port Perry district the more general scheme has been indorsed by the municipalities. This calls for a 71-mile line.

The new car line along Terauley, Agnes, Anderson and St. Patrick street was opened for service on Saturday, November 1st. It is hoped this new outlet will considerably relieve the down-town congestion.

Arrangements have been made by which the Edmonton Interurban Railway Company are allowed to connect up their line with the Edmonton municipal system. The interurban company are operating a gas electric car at the present time and will have another in service in the near future.

The construction of the railway line to Shaganappi Park which has been suggested by certain parties interested in real estate at that point will not be undertaken by the municipality of Calgary. This decision was arrived at following a lengthy meeting and discussion which resulted in an adverse vote of 28 to 5.

By a decision just handed down by the Privy Council the Toronto and York Radial Railway will not be allowed to deviate their Yonge street track at Farnham avenue. This practically means that when the franchise expires in 1915 the company will have no means of entering their North Toronto station unless they can come to terms with the city in the mean time.

By direction of the Montreal controllers, Mr. G. R. MacLeod, the municipal railways and tramways engineer, compiled a report on suggestions made by various aldermen as to new tramway lines required in the outer wards. This, however, has been referred back for Mr. Janin, the chief engineer, and Mr. MacLeod to make recommendations as to what they consider necessary to meet public requirements.

Interests in connection with the Winnipeg Electric Railway Company have acquired what is known as Big Bonnet Falls on the Winnipeg River. These falls will be developed by a subsidiary company and the street railway company will take the full output of the development. It is the intention, as soon as the engineering staff can be organized, to start development work. From data in the possession of the company this site when fully developed will be capable of turning out from 80,000 to 100,000 horsepower.

New Books

Electric Circuit Theory and Calculations—By W. Perren Maycock, M.I.E.E.; Whittaker & Company, London and New York, publishers; price 3/6. The object of this book is to explain the theoretical principles underlying numerical problems relating to electric-installation circuits, and to show how such problems may be worked out. The magnetic circuit, which concerns design work rather than installation, is omitted. A collection of examination and other questions, at the end, form useful exercises for the reader, and as the work is intended for beginners a part on arithmetic has also been included. A number of well chosen illustrations have increased the practical value of the book.

The Dealer and Contractor

Isolated Plant in New Y.M.C.A., Toronto — The Wiring and Lighting of a Large Public Building

A very complete isolated plant has just been placed in operation in the new Y. M. C. A. building, College Street, Toronto. There are two units, both engine driven, one of 50 kw. and one of 75 kw. direct current, 230 volts, 3-wire, Bruce-Peebles manufacture. The engines are twin cylinder 10 x 10 x 6, 550 r.p.m. Goldie-McCulloch manufacture. The plant is illustrated in Fig. 1.

The current is carried from the generators by cable in conduit, in an underground waterproof trench, to the main switchboard which is a three-panel type with circuit breakers, volt meters, ammeters, etc. The generating equipment and main switchboard were supplied and installed by Mr. R. H. Nichols, Dineen Building, Toronto.

From the main switchboard the current passes by overhead conduit to the distributing board which is located in a separate adjoining room. The main switch and metering board was supplied by the Canadian Krantz Electric Manufacturing Company, Limited. In addition to the usual instruments this board is of polished black slate, mounted on an angle iron frame with grills at each end and on top. This board is back connected with laminated bus-bars and lugs for all switch connections. Knife switches are of polished copper with enclosed fuses and name plates on each switch. The following double or single throw 3-pole switches are mounted on the board:—

Lighting section, 110/220 volts—1-350 ampere, 1-250 ampere, 3-100 ampere, 5-75 ampere, 3-50 ampere, 1-25 ampere.

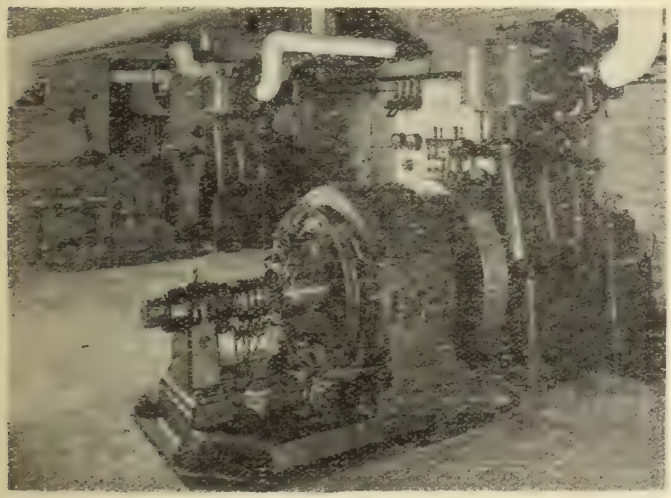


Fig. 1—Steam engine driven generators—New Y.M.C.A.

Power switches 240-480 volts—2-100 amp., 3-50 amp., 4-25 amp.

The board distributes current for lighting, ventilating fans, vacuum cleaners, elevators, sump-pump and swimming tank pump. There are five ventilating fans operated by Sprague motors of approximately 5 h.p. capacity each. The vacuum machine is a Spencer turbine cleaner, 4 sweepers, with 37 outlets, operated by a 10 h.p. motor. The swimming tank pump is operated by a 5 h.p. Bruce-Peebles motor.

There are 15 panel boards of Krantz manufacture B.3-2 wire, 110/220 volts, installed throughout the building, ranging from 6 to 34 circuits, all circuits being controlled by knife switches. These panels are of the finest polished black slate and all copper is polished and lacquered.

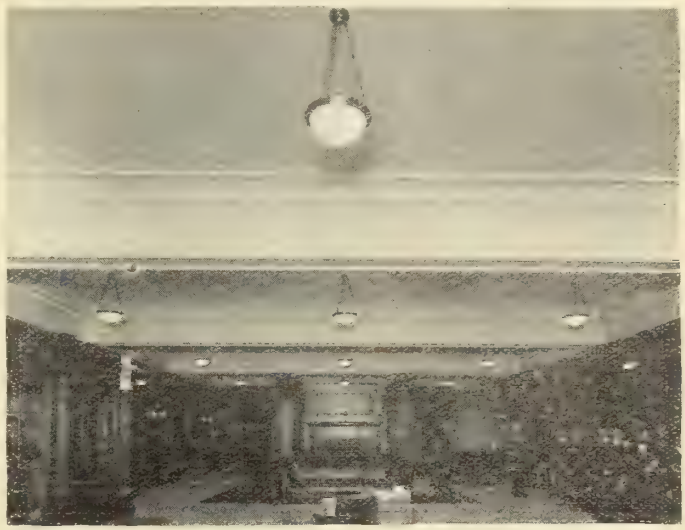


Fig. 2—The main hall has semi-indirect units.

There is nothing unusual in the wiring arrangement. The wires are all carried in conduit to the outlet boxes and there is no exposed work whatever in the building. In all there are 996 ceiling outlets and 29 wall outlets for lighting: in addition there are a few Diamond H wall plugs and 7 lantern floor plugs. These latter are all of a heavy type manufactured by the Russell-Stoll Company, New York. All push type switches are of the Diamond H Variety. A complete telephone equipment is being installed by the Bell Telephone Company. The wiring was installed complete by Bennett & Wright. The conduit was supplied by Conduits Company, Limited.

The types of fixtures used in the various rooms are of special interest. Both direct and semi-indirect units have been utilized, Fig. 2 shows one end of the main entrance hall which is entirely lighted with semi-indirect bowls fourteen inches in diameter suspended by three brass chains approximately two feet from the ceiling. As may be seen from the figure the feed wires are run down the chains so that nothing is visible which will detract from the artistic appearance of the fixtures. Each bowl contains three 40-watt lamps. These bowls, as shown, are suspended from a metal ring frame and provision has been made in these frames so that a cover glass of plain window quality can be laid above the light units as a lid to the fixture. This is done with the idea of keeping dust and dirt out of the bowls

so that these and the lamps will be clean at all times. The plain glass covering, being flush with the top of the bowl, can be brushed off and kept clean with a minimum of labor. In addition to the rotunda, the offices, social rooms, library



Fig. 3—Fixture used in hall-ways.

and a large auditorium are lighted in the same way by the indirect type of fixture shown in Fig. 2 and the resultant illumination is remarkably even and satisfactory.

The corridors throughout are lighted by direct units set up close to the ceiling as shown in Fig. 3. The supporting base is of bronze finish. In the classrooms this same type of unit is used in fixture groups of two or four, the units being inverted and constituting a semi-indirect system of a very simple and effective character. The fixtures here are also finished in dark bronze and combine low cost with efficiency and pleasing appearance.

The bedrooms are fitted with units similar (only smaller) to that shown in Fig. 3, but these are suspended by a flexible cord and the socket is supplied with a short chain to switch



Fig. 4—One corner of the swimming pool.

the lights off and on. The ceiling canopy used in the bedrooms is of white porcelain which can be easily cleaned and fits in well with the simple decoration of these rooms.

A corner of the swimming pool is shown in Fig. 4. In this case the lamps are enclosed in spherical globes. Though these sacrifice the efficiency of the system somewhat they give an excellent general illumination of the pool and the units do not interfere in any way with the swimmers.

The gymnasium for the most part are fitted with 150 watt tungstens in clusters of three, hung high, with a broad steel reflector, the lamps being enclosed in a wire guard cage. Under the galleries a similar unit is used containing only one lamp.

Each of the five bowling alleys is illuminated by six



Fig. 5—Main entrance, showing solid bronze standards.

Benjamin enamel steel reflector sockets containing 100 watt lamps.

Each billiard table is lighted by three fixtures suspended from the ceiling by brass chains, the reflectors in this case being aluminium, parabolic type, about 14 inches in diameter.

Fig. 5 shows two solid bronze standard lights installed at the main entrance. The lamps are enclosed in 12-inch spherical globes.

The glassware throughout is Moonstone manufactured by the Jefferson Glass Company. The fixtures were designed and manufactured and the complete installation made by McDonald & Willson, Limited.

The Barcelona Traction Company

In connection with the new enterprise of Dr. F. S. Pearson in Barcelona, Spain, known under the name of The Barcelona Traction Company, and in which considerable Canadian money is invested, the well-known Swiss turbine builders, Escher Wyss & Company, have secured large contracts for the supply of water wheels and pipelines. Besides an auxiliary plant of 4,000 horse-power, four large installations are being equipped, three of which utilise water from the river Ebro. The first installation comprises five units of 16000 h.p. each under a head of 140 feet and is nearing completion. For the second and third, the turbines are well under way in the works and are being rushed to completion. These installations comprise in one case four units of 15000 h.p., under a head of 250 feet and in the other, four units of 11500 h.p., under a head of 165 feet. The same company are supplying the water wheels and pipelines for a high pressure plant in the Pyrenees, built by a subsidiary company at the Barcelona Traction Company; in this plant there are five turbines of 7000 h.p., capacity each, under a head of 2800 feet.

Association of Sign Manufacturers

Members of the electrical trade will be interested in the announcement of the organization of the National Association of Electric Sign Manufacturers. The membership includes manufacturers of electric sign and illuminated advertising displays in Class A; and manufacturers of electric sign materials and accessories in Class B. This association has been agitated for a long time and the need of it is plainly set forth in the objects of the association which are as follows:—

1. To combat hostile sign legislation, local and at large. To change unfair and restricted city ordinances pertaining to electric signs; and to oppose taxes and licenses on signs.

2. To disseminate a knowledge of the benefits of electrical advertising. This will be accomplished by means of advertisements, photos, and write-ups in the popular magazines, merchants' trade papers in all lines, and through the press associations.

3. To generally promote the welfare of its members.

4. To maintain a bureau in charge of the secretary which shall guard members of the association against employing agents or salesmen who have proved dishonest with other companies.

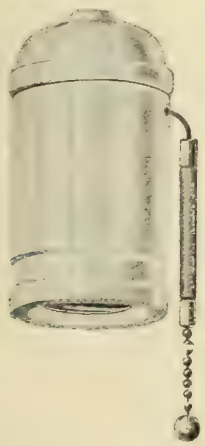
5. To establish an "association standard" for high quality of material, workmanship and design and to impress on the public the merit of "association standard" goods.

6. To combat the growing evil of stealing sketches and matching prices.

Individuals and firms interested in affiliating with the association, should address the Secretary, 315-21 South Warren Street, Syracuse, N.Y., for membership application blanks.

New Porcelain Pull Socket

A new porcelain pull socket has been placed on the market by the Arrow Electric Company of Hartford, Connecticut, as illustrated in the accompanying cut. Instead of being equipped with the ordinary ball chain the socket is operated by a short piece of strong weatherproof cord to which is fastened the insulated chain. The cord slides easily through the

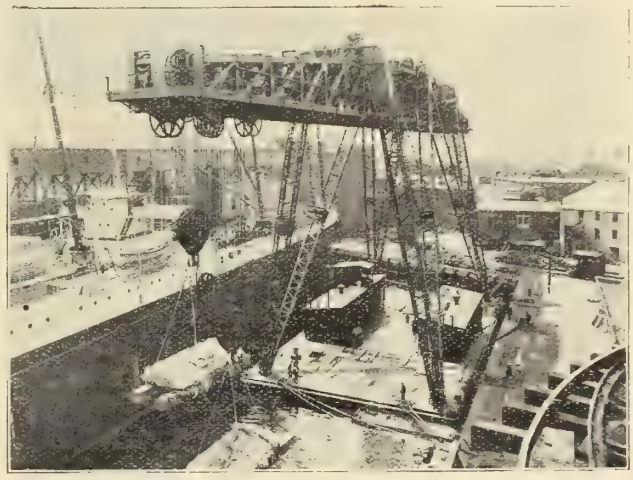


opening in the porcelain shell, making an easy-acting socket, and the cord has been proven by tests to be even more durable than the ball chain on this type of socket. This company is represented in Canada by the Northern Electric & Manufacturing Company.

British imports of electrical goods and apparatus other than machinery and insulated wire for the nine months ending September 30th, 1913, were £1,130,923. This is an increase of £94,547 over the similar period for 1912 and £118,280 over the same period for 1911.

Accurate Control of Giant Floating Cranes

The accompanying illustration shows one of two new pontoon cranes recently made for the United States Navy Department by the Wellman-Seaver-Morgan Company. One of these 150-ton cranes is for Boston Harbor and one for Pearl Harbor, Honolulu, and are to be used for unloading to lighters where good harbor facilities are lacking and for handling, removing or replacing such machines and apparatus as turrets, boilers, guns, etc., on battleships. Two of the rigid tests made by the Navy Department engineers before



150 Ton Floating Crane in Action.

acceptance and referred to below are an indication of the accuracy of control provided by the magnetic type controllers which were installed by the Cutler-Hammer Manufacturing Company.

In order to test nicety of landing heavy weights, the weight was suspended over an empty oil can, with block on top of it, and then lowered so as to strike block, being stopped upon signal. It is possible to stop the load without injuring the oil can or deforming it. To further test this point, the weight was suspended about two inches over the block and then lowered to see how close it could be brought without touching. It was brought within 1-16 in. of the block.

New Companies

The Shipman Electrical Company, Limited, has been incorporated, with head office Winnipeg, Man.

The National Electric Manufacturing Company, Limited, has been incorporated in the province of Alberta, with head office Calgary, Alta.

The Quebec Development Company, Limited, of Montreal, has been incorporated with a capital of $2,500,000.

The Ottawa Traction Company, Limited, has been incorporated, the capital stock $10,000,000, and head office Ottawa.

The Manitoba Electric Water Heating Company has been incorporated, with head office Winnipeg.

The C. E. A. Carr Company has been registered to carry on business as manufacturers' agents in railway supplies.

Heinze Electric Company, Limited, has been incorporated to manufacture and deal in electrical apparatus and supplies, with head office at Walkerville.

The Electric Manufacturing Company of Canada, Limited, has been granted a charter, head office Montreal, Que.

The Valleyfield Water Power Company, Limited, has been granted a charter by the Dominion government, head office Valleyfield, Que.

The Economy Fuse & Manufacturing Company of Canada, Limited, has been incorporated, head office, Montreal, Que

Canadian Porcelain Company, Limited

The cut herewith shows the factory of the Canadian Porcelain Company, Limited, of Hamilton. The company was organized under Dominion charter, in November, 1912, for the purpose of manufacturing electrical porcelain and allied products. The plant covers an area of 45,000 square feet and is equipped with the most modern machinery for the production and testing of high voltage line insulators. Electric drive supplied by the Hydro-electric Power Commission of Hamilton is used throughout. Natural gas and bituminous coal will be used as fuel. Raw materials will be secured largely in Canada and England.

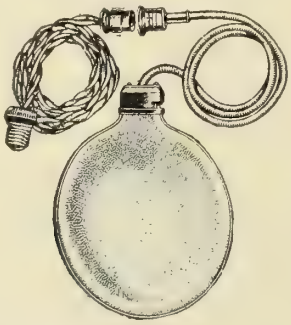


New Factory of Canadian Porcelain Company, Limited

Mr. Walter Goddard formerly with the Locke Insulator Manufacturing Company of Victor, N.Y., is president and in direct charge of the company. Mr. F. D. Palmer, of Galt, is vice-president, and Mr. John Alden, of Rochester, secretary-treasurer.

New Type of Warming Pad

A new type of electric warming pad is being placed on the Canadian market by the Hotpoint Electric Heating Company who have recently opened a factory in Toronto. This new device is constructed of aluminium, is about 8 inches in diameter, 5/8 inch thick, concave on one side and convex on the other to fit the body curves. Any temperature between



100 and 200 deg. F. can be secured by simply moving a small lever or the heat can be cut off altogether by a separate switch within easy reach of the user. The heating element in this pad is the same as in the well-known Hotpoint iron and is covered by absolute guarantee. The many advantages this form of pad possesses over the various other styles already in use are claimed by the manufacturers as greater cleanliness, safety, durability and efficiency.

Electric Operation Cheapest

In a recent article on the subject of Drainage and Irrigation, read before the Association of Drainage and Levee Districts of Illinois, it was stated that "all the evidence shows that if a supply of electric energy can be bought for 4 cents per kw.h., that the total cost of pumping by electricity does not exceed the total cost of pumping by steam in well designed steam stations. If a district is able to obtain a lower rate than 4 cents per kw.h. for energy, they are able to save money over the cost of operating steam stations."

The municipal council of Maisonneuve will receive tenders till November 19 for extensions to their pumping system.

Trade Enquiries

1520. **Electric Heaters.**—A South African firm solicits correspondence on electric heaters of Canadian manufacture.

1521. **Electric Irons.**—An Orange Free State firm would like to get in touch with Canadian exporters of electric irons.

1725. **Electrical generators, motors, etc.**—A Yorkshire company manufacturing electrical generators, motors, etc., wishes to get into touch with some first-class Canadian resident firm who possess the requisite connection for introducing and selling their appliances.

Trade Publications

Soot - Cleaner—A booklet issued by G. L. Simonds and Company, Chicago, describing the Vulcan soot cleaner.

Flow Meters.—Bulletin A4157, issued by the Canadian General Electric Company, describing their steam, water and air flow meters.

Transformer Drying—Bulletin number A4134 issued by the Canadian General Electric Company on transformer drying and the drying, filtering and testing of transformer oil.

Metal Moulding—A catalogue issued by the National Metal Moulding Company of Pittsburgh, Pa., and distributed by their Canadian agents the Canadian General Electric Company.

Bus Bar Supports—The Delta-Star Electric Company, Chicago, have issued an exceptionally complete bulletin devoted to high tension bus bar and wiring supports. With the standard units listed over 7,000 combinations are possible thus greatly simplifying high tension stations and switchboard wiring.

Crouse-Hinds.—A folder has been issued by the Crouse-Hinds Company of Canada drawing attention to Canada's bumper wheat crop which will result in renewed prosperity and increased demands for high quality products such as condulets, fittings, panel boards, switches, etc., etc., manufactured by this company.

Railway Supplies.—A bulletin issued by the Electric Service Supplies Company, descriptive of car equipment. Their list is very complete and the booklet particularly well illustrated. The same company are distributing a folder entitled "What Keystone steel gear cases will give you," and a second folder entitled "For Winter," describing auxiliary railway equipment of special need in winter-time.

Westinghouse Publications—The following pamphlets have been issued by the Industrial & Power Department of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.:—Motor-driven Refrigerating and Ice-making Machinery; Number 17 on Small Motors, describing vehicle equipment; Motor-driven Dairy, Creamery and Ice Cream equipment; Westinghouse Watthour A.C. Meters; the Electric Breakfast Set; and Number 5 of the Textile Quarterly, which deals with electrically-driven pickers.

Current News and Notes

Atikokan, Ont.

The Canadian Northern Railway Company are installing a stream electric plant at this point for lighting purposes.

Aurora, Ont.

The Town of Aurora, Ont., is installing an equipment of motor-driven turbine pumps for protection against fire. It will include two four-stage high lift turbine pumps of Mather and Platt design, built by Canadian Allis-Chalmers, Limited. Each of these fire pumps will be capable of delivering four hundred imperial gallons per minute, against a total head of 325 feet, operating at 1465 r.p.m. They will be direct connected at one end to an alternating current motor, and at the other end to a direct current motor in order to conform with the Underwriters' requirements that there must be two distinct sources of power for this purpose. The electrical apparatus including a four panel switchboard will be built by the Canadian General Electric Company, Limited.

Ayr, Ont.

A by-law will probably be submitted on January 1 authorizing the council to close a contract with the Hydro-electric Power Commission of Ontario. The plant is at present municipally owned.

Brockville, Ont.

On October 21 the council passed a by-law to spend $69,000 on light and power extensions.

Brantford, Ont.

On January 1 the city of Brantford will elect two members who with the mayor will constitute the Hydro-electric Commission, and will have charge of all electrical matters.

Burford, Ont.

It is expected a by-law will be submitted on January 1st to authorize the council to make a contract for the supply of power from Niagara Falls.

Calgary, Alta.

Tenders are called to November 18th, by the city of Calgary, for a 1000 kw. synchronous motor-generator and exciter set.

Elmira, Ont.

Niagara power was turned on at Elmira on October 29. This village with a population of only 200 has contracted for 250 h.p., probably establishing a new record.

Elora, Ont.

The by-law to raise $10,000 for an electric distribution system carried by a majority of 200 to 8. Elora will contract for 200 h.p.

Estevan, Sask.

The town of Estevan is making an addition of two Babcock and Wilcox boilers fitted with Dutch oven furnaces for burning low class lignite mined in that district; also one compound quick revolution forced lubrication Goldie & McCulloch engine driving a Westinghouse alternator and exciter. The street lights are being improved by putting in sixty 5-light standards and adding light and power main to the capacity of about 20 wire miles.

Forest, Ont.

Further contracts for the new power plant including meters and transformers have been awarded to the Canadian Westinghouse Company. Mr. H. A. McLean, Sarnia, is engineer in charge.

Fergus, Ont.

The by-law was carried on November 3 to expend $16,000 on an electric distribution system. The vote was 174 for to 11 against.

Fort Frances, Ont.

The town of Fort Frances is issuing debentures to the amount of $10,000 to cover the cost of the electric distribution system, which is already built. No immediate extensions are anticipated.

Fort William, Ont.

The earnings of the Kaministiquia Power Company for the ten months ending August 31, 1913, amounted to $208,580, as compared with $216,740 for the previous twelve months. This indicates that the current year's earnings will be largely in excess of the previous year.

The city council will require a quantity of 500,000 c.m. armoured cable to carry the power supply to their new line on Island No. 2.

Professor Herdt, of McGill University, has been appointed one of the arbitrators to determine the comparative cost of electrical energy as supplied to the town of Fort William by the Kaministiquia Power Company.

Guelph, Ont.

At a special meeting of the Guelph city council on October 22nd a resolution was passed recommending that the Hydro-electric Power Commission be asked to make a report on the cost of constructing and operating an electric railway connecting Hespeler, Puslinch Lake, Guelph, Elora, Fergus, Arthur, Mount Forest, Meaford and Thornbury. Owen Sound has also expressed a desire to have the line run to that point.

Hamilton, Ont.

Plans have been completed by the Dominion Power and Transmission Company for the erection of car sheds to be placed on the old site occupied by the sheds that were recently burned.

The cost of street lighting for the year 1914 is estimated at $64,800. This would care for 360 arc lamps and approximately 8,000 tungstens.

The Dominion Power & Transmission Company are contemplating the erection of a steam plant in Hamilton, consisting immediately of 2 units of 10,000 h.p. each with provision for a further addition of 2 similar units. While tentative plans have been prepared it has not yet been decided when the work will be undertaken.

The Hydro-electric System will in the future be administered by a commission of three, consisting of two selected members who will hold office for two years and the mayor who is an ex-officio member. Each will be paid a salary of $1,000.

Herbert, Sask.

The Herbert Electric Light Company, controlled by Mr. H. M. Klassen, is now operating in the town of Herbert. The equipment consists of a 50 brake h.p. Ruston Proctor

producer gas engine and a 30 kw. Westinghouse generator, 2 kw. exciter and switchboard.

Hanley, Sask.

A contract has been awarded to the British Canadian Engineer & Supply Company for a producer gas electric plant. Work on the installation will commence shortly.

Kamloops, B.C.

The new steam plant was started up on October 29th. This plant will be operated as an auxiliary to the hydro-electric plant now under construction when the latter is completed.

Kingsville, Ont.

The Edison Electric Light Company have commenced work on the construction of a transforming station at Kingsville, Ont.

Lacombe, Alta.

Mr. J. C. Gibson of the Lacombe and Blindman Valley Electric Railway Company recently stated that 8 miles of grading is completed and contracts for ties and rails are being let. It is expected the rolling stock will consist of gasoline electric cars.

London, Ont.

The London Street Railway Company will require the necessary equipment to transform 1000 h.p. of electric energy, alternating current, as supplied by the city sub-station to 550 volts a.c. as used by the railways.

Before the city of London can proceed with the electrification of the London and Port Stanley Railway line it will be necessary to obtain the consent of the Dominion Railway Board. This threatens to complicate matters somewhat as it will be necessary to convince this board that the proposition is commercially sound.

The Toasted Corn Flakes Company, 584 Grey street, London, Ont., are in the market for 25 cycle, 3 phase motors of a total capacity of 300 h.p.

Medicine Hat, Alta.

The new steam turbine unit of 750 kw. capacity was placed in operation early in November. The boilers are gas-heated. This brings the capacity of the Medicine Hat plant in the neighborhood of 2,000 h.p.

On November 24 a by-law will be submitted regarding expenditure of $150,000 on electric power plant extensions.

Mirror Lake, B.C.

A somewhat unique plant was placed in operation at Mirror Lake, B.C., on October 29th. A number of local ranchers recently formed a company to develop a small water power and purchased a second-hand 36-inch Pelton water wheel and an Edison 35 kw. 110 volt generator which had formerly been used by the Nelson Power & Light plant. The majority of the construction work including the building of some 100 feet of pipe line was undertaken by the ranchers themselves. The company which has been formed is known as the Mirror Lake Electric Light Company.

Montcalmville, Que.

The city council is considering the installation of an ornamental street lighting system.

Montreal, Que.

The Montreal Council have prepared a by-law in connection with the underground conduits on St. Catharine Street and Bluery Street and Park Avenue. This provides that all buildings to be constructed or in course of construction in which electricity will be used for light or power shall be so wired that electrical service connections can be made to the underground distributing system; all existing buildings must have their service connections arranged by May 1, 1914. All work is to be done in accordance with the rules and regulations of the National Board of Fire Underwriters. A penalty not exceeding $40 or two months' imprisonment may be imposed in default of carrying out the by-law.

The earnings for the first four months of the company's year of the Montreal Light, Heat and Power Company amounted to $968,624 as compared with $883,002 for the same period a year ago.

We understand the Southern Canada Power Company are preparing plans to go ahead with hydro-electric development which was recently planned by the South Shore Power and Paper Company. The water power is situated on the St. Francis River near Drummondville.

During the last financial year the gross receipts of the West Kootenay Power & Light Company were $415,413, an increase of $82,549, while the operating costs were $115,279, or $5,022 higher, leaving the net $300,134, a gain of $77,527. Four per cent. was paid on the common stock. The company anticipate a further increase in net earnings from the electrification of that section of the Canadian Pacific Railway between Rossland and Castlegar Junction, contracts having been let for the electrical apparatus required for the work. The section should be in operation by the autumn of next year. The following are the officers and directors for the ensuing year:—C. R. Hosmer, president; L. A. Campbell, vice-president; W. R. Baker, Edwin Hanson, Frank Paul, Geo. F. Benson and W. J. Shaughnessy.

The Westbury Electric Light & Power Company has been incorporated with a capital of $75,000. The directors are H. A. Worby, manager, Robert C. Cowling, secretary-treasurer, and the place of business, Cookshire, St. Francis, P.Q.

Nelson, B.C.

The shareholders of the Nelson Street Railway Company will sell out to the city at the rate of 50 cents on the dollar, payable in 25-year 5 per cent. debentures. Certain repairs and extensions will be made to the line.

Outlook, Sask.

A by-law was recently passed to expend $10,500 for electric light extensions.

Owen Sound, Ont.

The town council has granted the Mayor the necessary authority to sign a contract with the Hydro-electric Power Commission of Ontario for the supply of 1200 h.p. of electric energy. The price is calculated not to exceed $31 per h.p. delivered at the town limits. A transmission line about 30 miles long will be required to transmit the current from Eugenia Falls where a water power will be developed.

Peachland, B.C.

On November 5 this municipality voted $1,000 for extensions to the electric light system.

Port Arthur, Ont.

The new belt line built by the Port Arthur municipality during the past summer was placed in operation on November 1.

Port Nelson, Ont.

It is expected that the Marconi Wireless station at Port Nelson, Hudson Bay, will be in operation in the early spring. Work will be carried on during the winter, the Government carrying out the construction of the station under the supervision of the Marconi Company.

Prescott, Ont.

Power was received for the first time on October 24th over the new transmission line which has been constructed by the Hydro-electric Power Commission between Prescott

and Morrisburg. In the near future the line will be completed to Winchester, Chesterville and other towns in the neighborhood. Power is being supplied temporarily from Morrisburg.

Port Colborne, Ont.

Tenders are called to November 20 for electric wiring and interior fittings of a public building here.

Quebec, Que.

Sitting at Quebec city, the Public Utilities Commission approved the grounding of transformers made by the Quebec Railway, Light, Heat and Power Company. The commission ordered the Dorchester Electric Company to allow its groundings to be inspected by Mr. James Bennett, of Montreal, who was nominated as the commission's engineer, his fee to be paid by the company. The Beauce Telephone Company renewed a complaint to the effect that an electrical system owned by Mr. Lessard at St. George, Beauce, was dangerous, and Mr. Lessard was again ordered to remedy the defects, under the supervision of Mr. Frigon, the inspector appointed by the commission, and to pay the costs.

Regina, Alta.

The street railway returns for the week ending October 18th are as follows—revenue $3,982; passengers carried 97,242; passengers carried including transfers 110,657. Corresponding figures for the week ending October 25 were $3,930, 94,963 and 108,834, and for week ending October 1, $3,998, 98,034 and 112,410.

Russell, Man.

A new gas-electric plant has just been placed in operation. The equipment consists of a Ruston-Proctor 72 h.p. engine and suction gas plant with 50 kw. Westinghouse generator, 2 kw. exciter, switchboard and all the accessories. This plant was installed complete by the British Canadian Engineering & Supply Company of Winnipeg.

Souris, Man.

A contract has been awarded for the installation of a small electric light plant to the Accumulator Lighting Company, Winnipeg, Man.

Smiths Falls, Ont.

Mayor Foster with a number of interested citizens recently visited Long Rapids on the Madawaska River, situated some eight miles out from Arnprior, where it is believed a hydro-electric plant could be installed at a reasonable cost.

A new 275 kw. Westinghouse generator was recently placed in commission. This now brings the generating capacity of the plant to over 1,000 h.p. and the machines are so arranged that they may be driven either by water or steam power. Mr. Ross O'Hara is superintendent of the plant and Mr. George Frost manager.

St. Catharines, Ont.

By a vote of 715 to 48 the by-law to expend $116,000 on a step-down transforming station and distributing system was carried by the property owners of St. Catharines. The by-law to grant a three years' renewal of the street lighting contract to the Dominion Power & Transmission Company was defeated.

St. John, N.B.

A generating plant with a capacity of 500 h.p. is being installed in the new elevator here; also a small lighting machine of 50 h.p. The equipment throughout the elevator will be motor driven. The W. J. O'Leary Company are in charge of the electrical construction work.

Saskatoon, Sask.

The rate charged by the city for power supplied to the street railway system will be reduced on January 1st to 2 cents per kw.hr.

It is understood arrangements have been made to extend the electric light and power line out to Factoria, a sub-division about three miles north of the city limits of Saskatoon.

The suburban electric line has been completed connecting Sutherland with Saskatoon, a distance of between two and three miles, and street cars have already been operated over the road.

St. Thomas, Ont.

The matter of erecting a large electric sign to advertise the city is being discussed by the council.

Estimates have been prepared on the cost of extending the city street railway system from the end of the Ross street line to Pinafore Park. The cost would be in the neighborhood of $30,000.

Thorold, Ont.

A by-law will be submitted on January 1 authorizing the construction of a street railway to accommodate the factories at the south end of the town.

Toronto, Ont.

The Canadian Stewart Company, who have contracted to do the work of dredging the Toronto harbour, have made a request for rates on 8,000 h.p. of electric energy.

A contract has been closed by the Toronto Hydro-electric Power Commission with the T. Eaton Company, Limited, for the supply of 2,500 h.p. to the latter company on a flat rate of $20.

Wolsely

Work is progressing on a 22 x 17 ft. addition to the municipal light and power plant in which an additional 30 kw. generator with exciter and switchboard is being installed.

Winnipeg, Man.

The Public Utilities Commission will inquire into and report upon the possibilities of a hydro-electric scheme for the benefit of the farmers of the province. Commissioner Robson has already invited representatives from people interested in the question and will attend at different points to investigate the various local propositions that may be suggested.

Tenders will be received by the Board of Control up to December 1st for next year's supply of meters.

Tenders have been received by the Canadian Credit Men's Association, Limited, at a rate on the dollar, for the stock, fixtures and machinery of the electrical business belonging to the United Electric Company.

Contract has been awarded the Imperial Wire & Cable Company for 5,500 feet of 2,200 volt, three core, paper insulated, lead covered cable.

Tenders have been received by the Board of Control for the supply and installation of five complete pumping units together with stepdown transformers, switchboard and accessories.

Mr. W. G. Chace, formerly chief engineer in charge of design and construction of the city's power plant, has been appointed chief engineer in charge of the new water supply system. It is anticipated that this work will take five years to complete, at an estimated cost of approximately $13,500,000. The object is to bring into Winnipeg from Shoal Lake, a distance of 92 miles, a supply of soft water by gravitation.

Messrs. Willoughby & Kelso have been awarded the contract by the city of Winnipeg for the erection of ornamental lighting standards on Main, Osborne and Hargrave Streets.

Yorkton, Sask.

Tenders are called to December 22nd for the supply and delivery of one 500 B.h.p. gas-electric unit.

Condensed Department

Publisher's Notice

Advertisements under "Situation Wanted" "Situation Vacant" or Miscellaneous, are charged at 2 cents a word per insertion, minimum charge 50 cents.

Advertisements for tenders, equipment, wanted or for sale, etc., are charged at $2.10 per inch.

All advertisements must be in the publisher's hands by the 10th or 23rd of the month to insure insertion in the subsequent issue.

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The lowest tender not necessarily accepted and the right is reserved to reject any or all tenders.

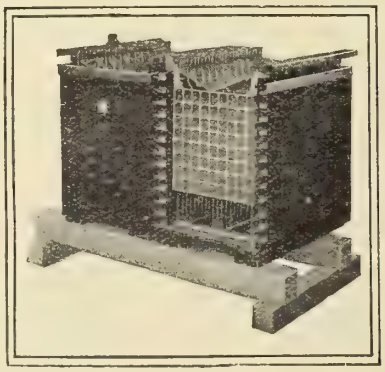
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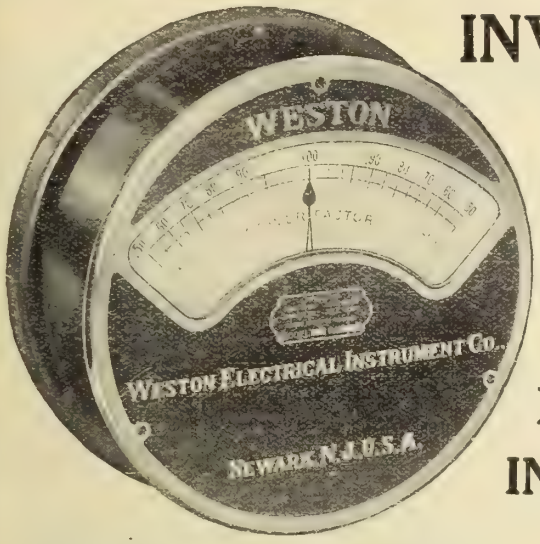
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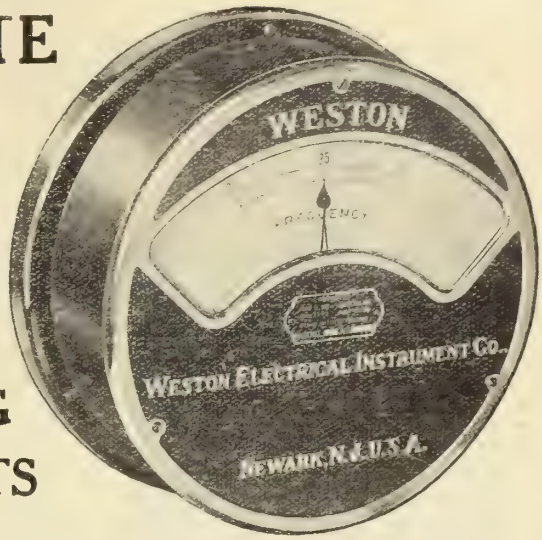


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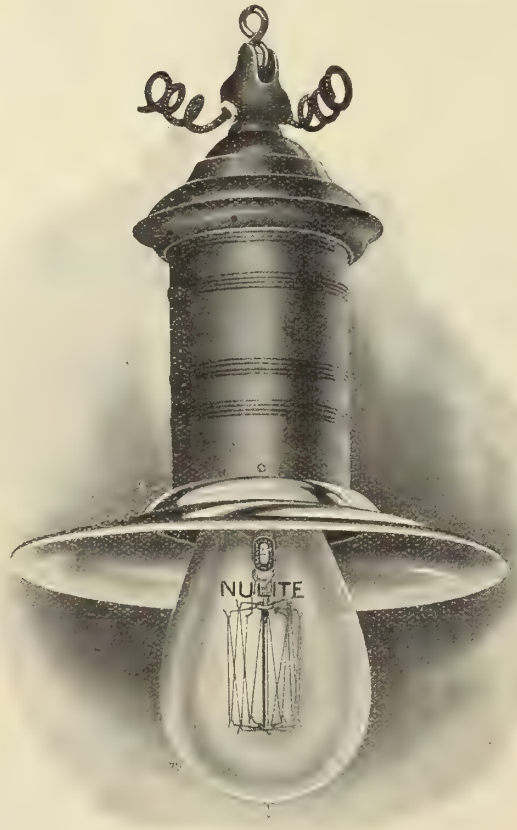
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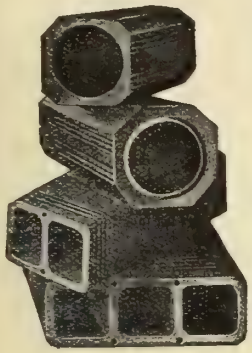


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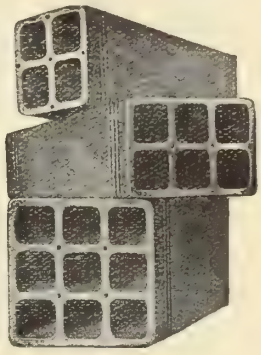


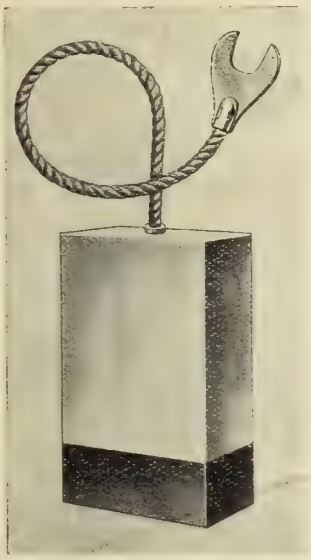
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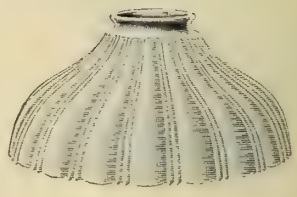
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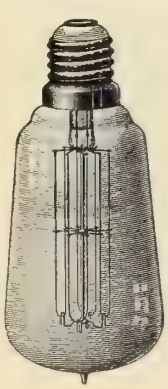
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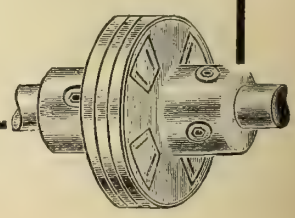
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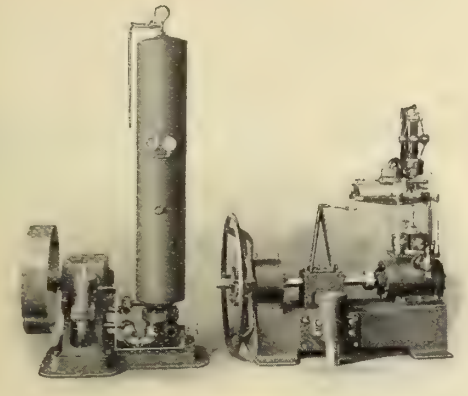
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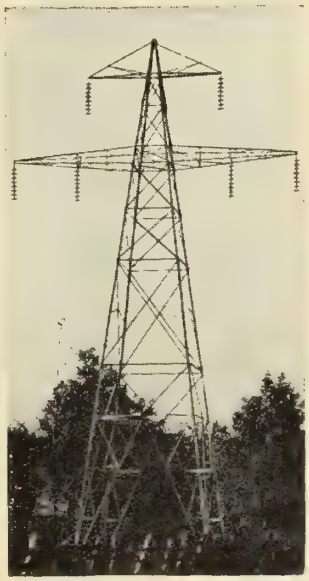


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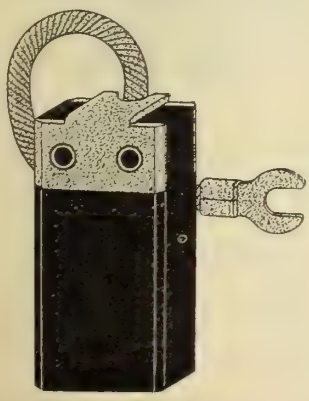
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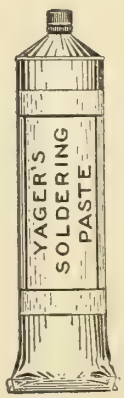
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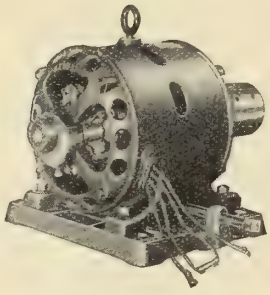
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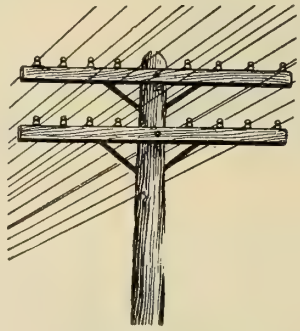
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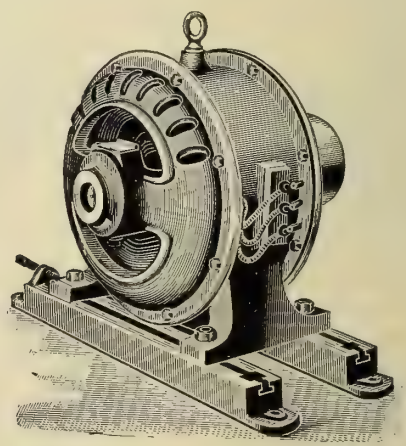
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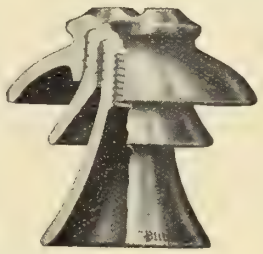
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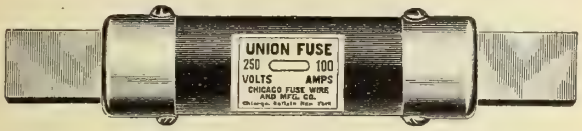
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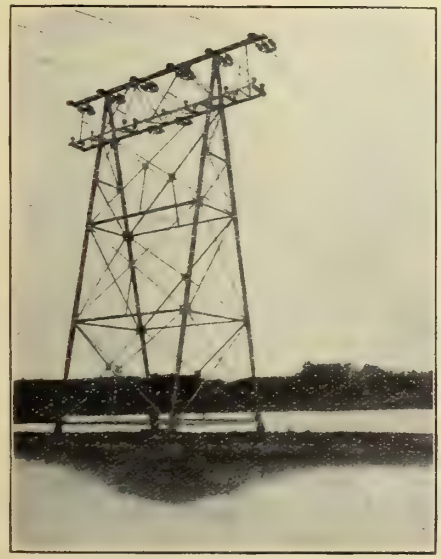
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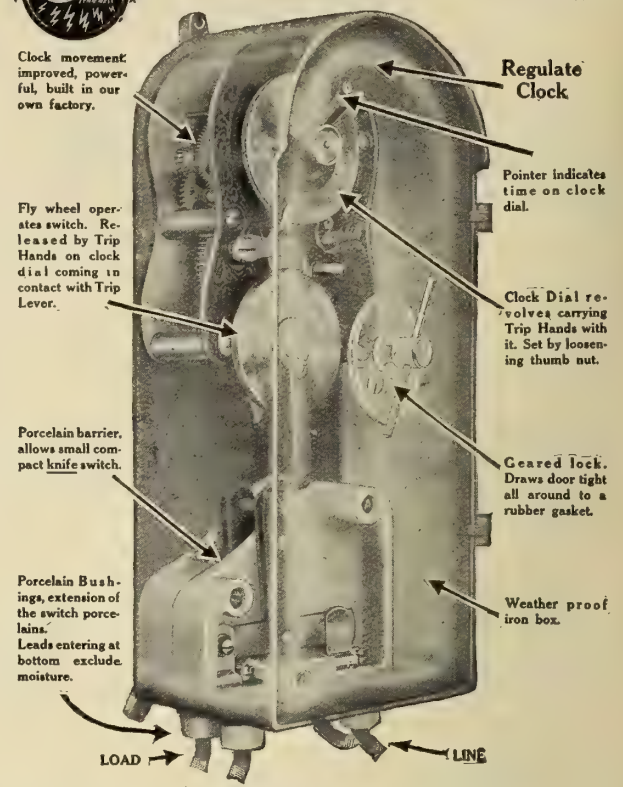
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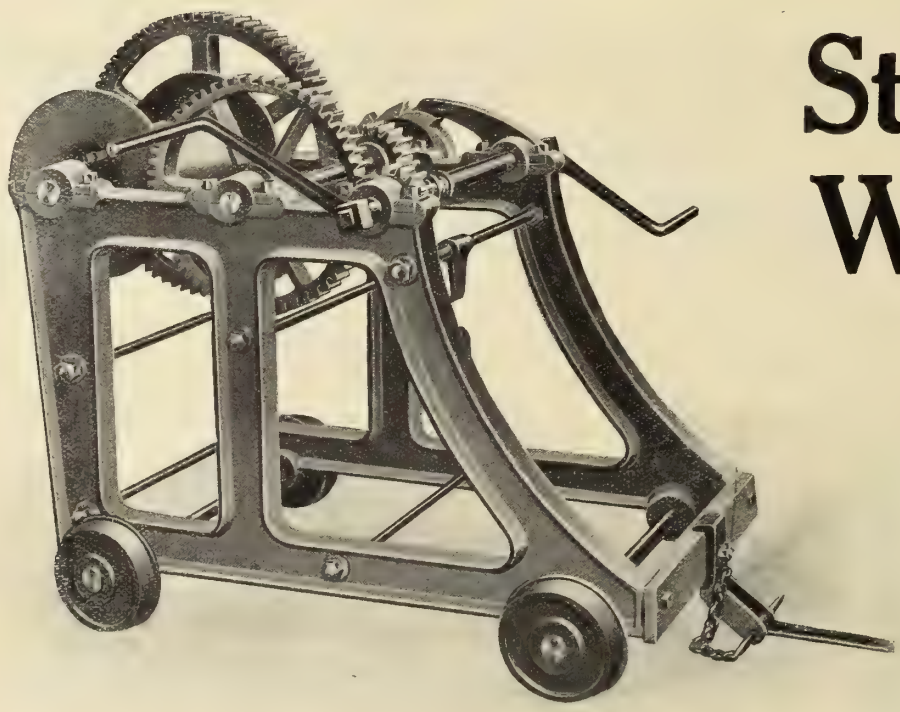
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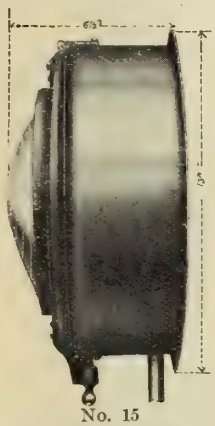
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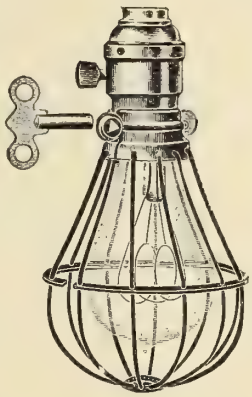
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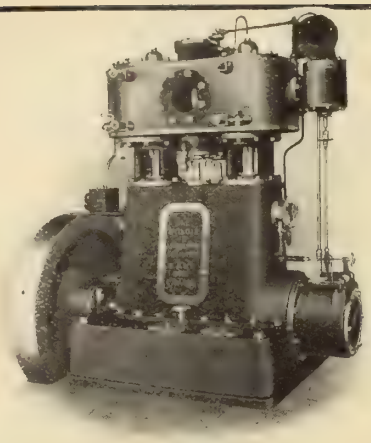
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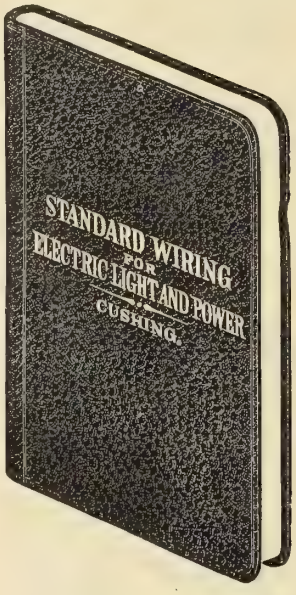
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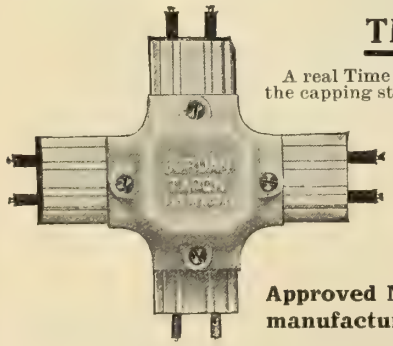
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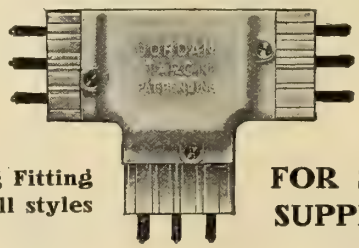
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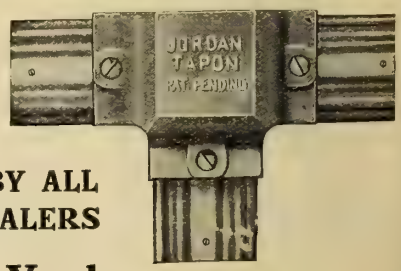
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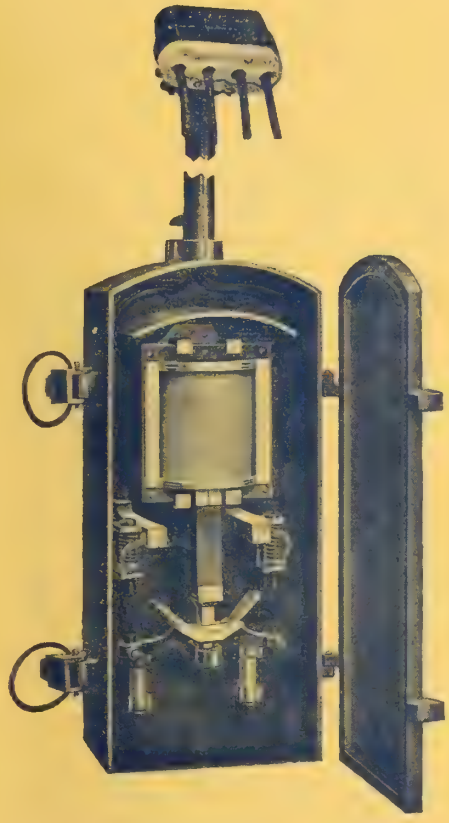




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162 Adelaide St. W., TORONTO

PUT $\frac{\text{ONE}}{\text{E}}$ = "STUNG"

Put One Over the Engineer

If he is easy, he don't deserve to get I-T-E Circuit Breakers. They were designed for people who know what they want.

To avoid being "stung," specify I-T-E and stick to it.

THE CUTTER COMPANY, Philadelphia

Rubber Covered Wires and Cables

For Power, Light and Telephone Work

INCANDESCENT LAMP CORD
FLEXIBLE SWITCHBOARD CABLES
Special Cords and Cables for all kinds of Electrical Work

Prompt Shipments from Canadian Factory

Boston Insulated Wire & Cable Co.

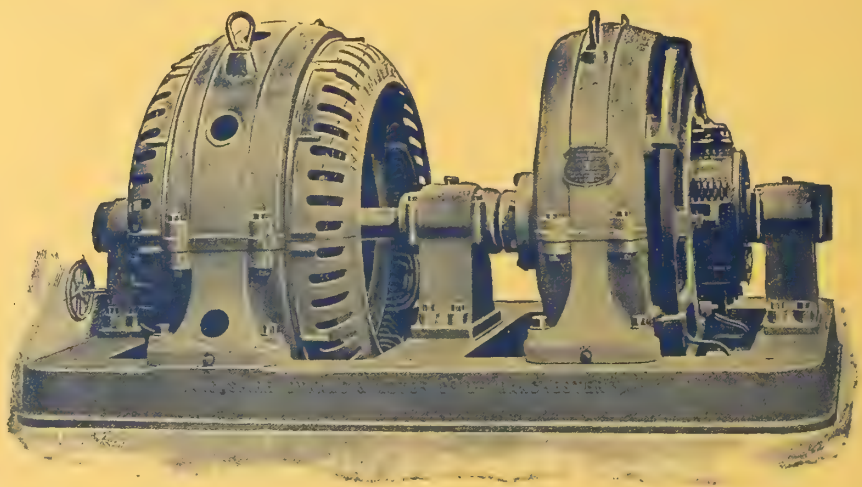
CANADIAN OFFICE AND FACTORY:

Hamilton, Ontario

Electric Motors for all Purposes

Curve Drawing Meters. Portable Type for Factory Use

The "Lancashire" Ball Bearing Induction Motor



The "Lancashire" Patent Reversing Drive for Metal Planers

Motor Generator—300 K.W. for Traction Service.

The Lancashire Dynamo and Motor Co. of Canada, Ltd.

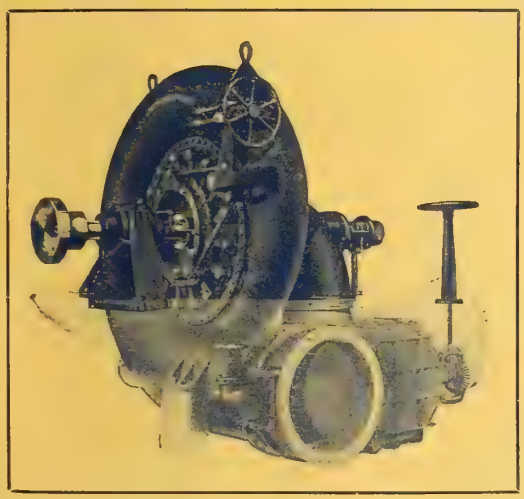
Montreal

107-109 Duke St., Toronto

Vol. XXII—No. 23 Toronto, December 1, 1913

Electrical News

Generation, Transmission and Application of Electricity



90% EFFICIENCY
From SMITH HYDRAULIC TURBINES

Recent tests at Holyoke, Mass. on Standard Smith Turbines have again proven their superiority over any turbine now manufactured.

These tests showing efficiencies from **89% to over 90%.**

We design and build turbines for heads from 5 feet to 650 feet. Engraving represents a turbine of 900 H.P., 250 R.P.M., 110 feet head.

Send for Bulletin N

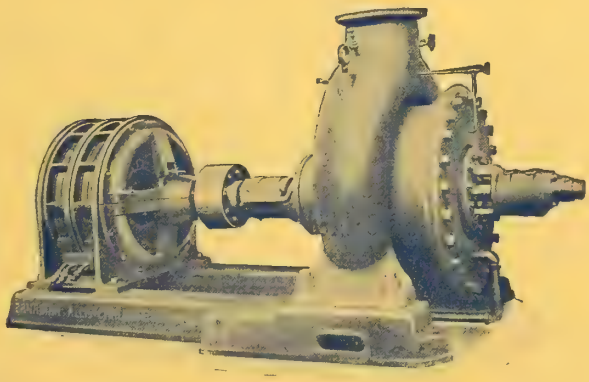
S. Morgan Smith Co., York, Pa.

Branch Offices: 176 Federal St., BOSTON, MASS.
614 American Trust Bldg., CHICAGO

ELECTRICALLY DRIVEN

TURBINE PUMPS

Working in parallel capacity of 2 units, 15,000,000 gals. per day against 200 ft. head.



Working in series capacity of 2 units, 7,500,000 gals. per day against 400 ft. head.

ONE OF TWO UNITS FOR CALGARY.
Driven by 450 H.P. Motors at 875 R. P. M.

CANADIAN ALLIS-CHALMERS, LIMITED

Head Office: King and Simcoe Sts., Toronto. District Sales Offices: Montreal, Halifax Ottawa Cobalt Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Victoria, Vancouver, Prince Rupert

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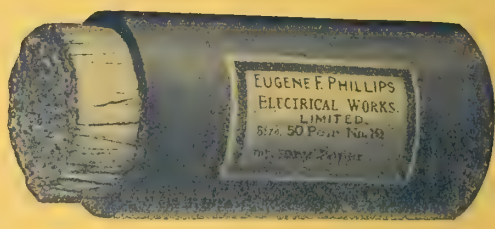
PHILLIPS



Bare and Insulated Copper

WIRES AND CABLES

For Telephone, Telegraph, Lighting,
Power and Street Railway Equipment

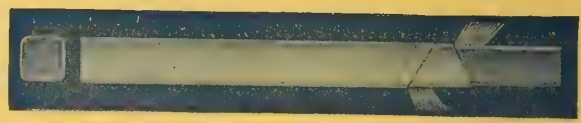


Bare and Insulated Electric Wire and Cables for Aerial and Underground use

Railway, Feeder and Trolley Wire



Weatherproof Magnet and Rubber Covered Wires and Cables

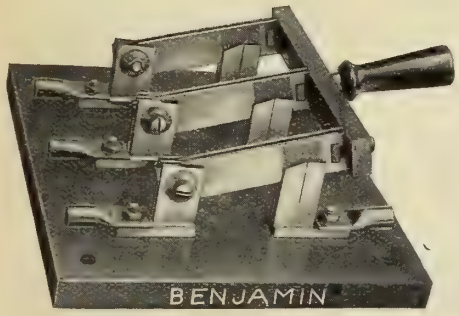


Incandescent and Flexible Cords

Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

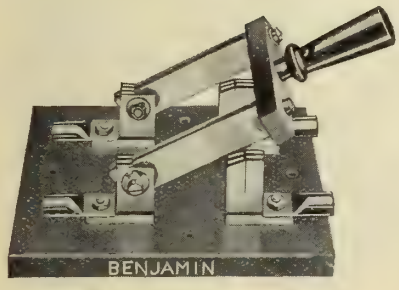
Branches: Halifax, Toronto, Winnipeg, Vancouver



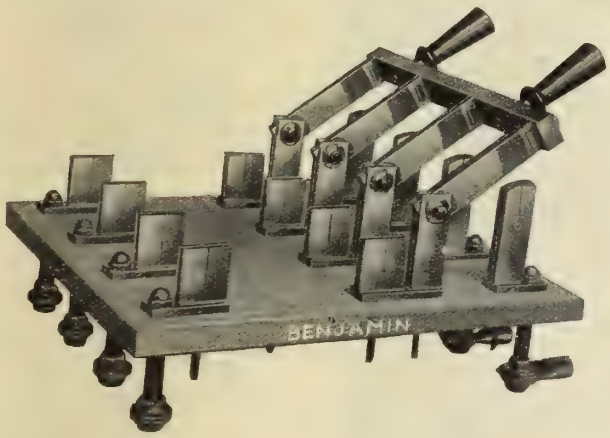
BENJAMIN

"ALL COPPER"

KNIFE SWITCHES



Type "A"
and
Type "C"



Material
Design
Workmanship
Strong and Rugged
Smooth Operation
Overload Reserve
Large Contacts
Large Radiation
Surface

Write for Bulletin "22S"

Benjamin Electric Mfg. Co.
of Canada, Limited
11-17 Charlotte St., TORONTO, CANADA

Ferranti Meters

Service Efficiency 100 per cent.

No matter how heavy or how light the load—Ferranti meters can always be depended on to register the current consumption accurately and consistently.

Illustration shows our Improved Type "C" Meter, Single or Polyphase; top or bottom conections; clock or cyclometer dials.



Guaranteed for Three Years

against all defects of mechanical or electrical nature.

Our meters are assembled and thoroughly tested at our Toronto or Winnipeg warehouses where a large stock is always on hand.

Get our prices and try us on a rush order.

Send a postal for complete descriptive catalogue.

Ferranti Transformers

Oil Immersed Pole Type

The most efficient and economically installed transformer on the Canadian market. Realizing the extreme necessity for permanent reliability, the design has been made very substantial to meet the requirements of every condition; all parts are easily accessible.



Single or Three Phase Current

Of these types the Ferranti Three Phase is the most efficient and is supplied to give any secondary voltage required — one transformer of this type does the work of three of the single phase type.

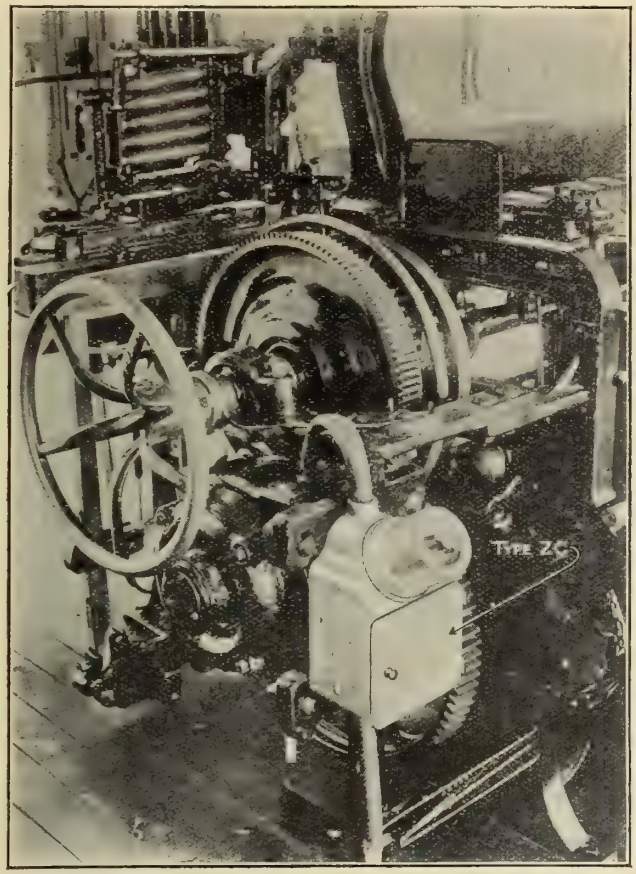
Let us quote you our prices and then judge for yourself.

NOTE OUR NEW WINNIPEG ADDRESS.

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building, Cor. Notre Dame & Langside, WINNIPEG



The Condulet Way is Safest and Easiest

The picture on the left is a view in a textile mill where each machine is operated by an individual motor.

Each motor is protected by fuses and controlled by a snap switch.

A type ZC Condulet provides a dust-proof housing for each set of fuses and a mounting surface for the snap switch. Thus, the Condulet is really a two-in-one fitting.

Condulets of the Z series include the four types shown below. Each type is made in all practical capacity and hub sizes, and is furnished with a universal cut-out fastening plate as well as an adjustable swivel and adapting rings for switches.

The Condulet Line Includes the Right Type and Size for Every Exposed Conduit Outlet Requirement of Lighting or Power Circuits.

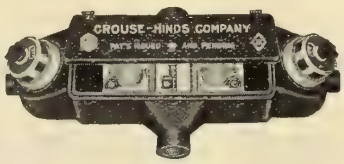
Fill in Coupon Below for Bulletins Nos. 100 and 101.



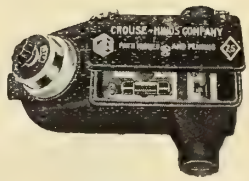
Type ZC



Type ZD



Type ZX



Type ZS

Crouse-Hinds Co. of Canada, Ltd.

Main Office and Works:

Toronto, Ontario, Canada

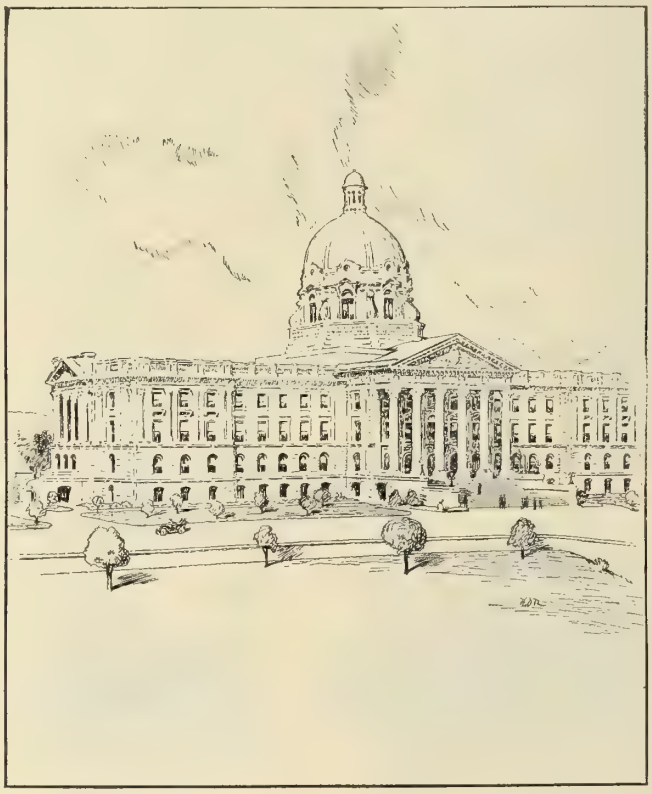
Kindly send me Bulletin Nos. 100 and 101

Name .....

City ..... Prov 21113

Across Canada with the
IMPERIAL WIRE & CABLE CO.
LIMITED

Toronto - MONTREAL - Winnipeg



Sixth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire & Cable Co.'s, Limited, wires.

This picture shows the Parliament Buildings, Edmonton.

This building was wired with "Adanac" Rubber Isulated Wire

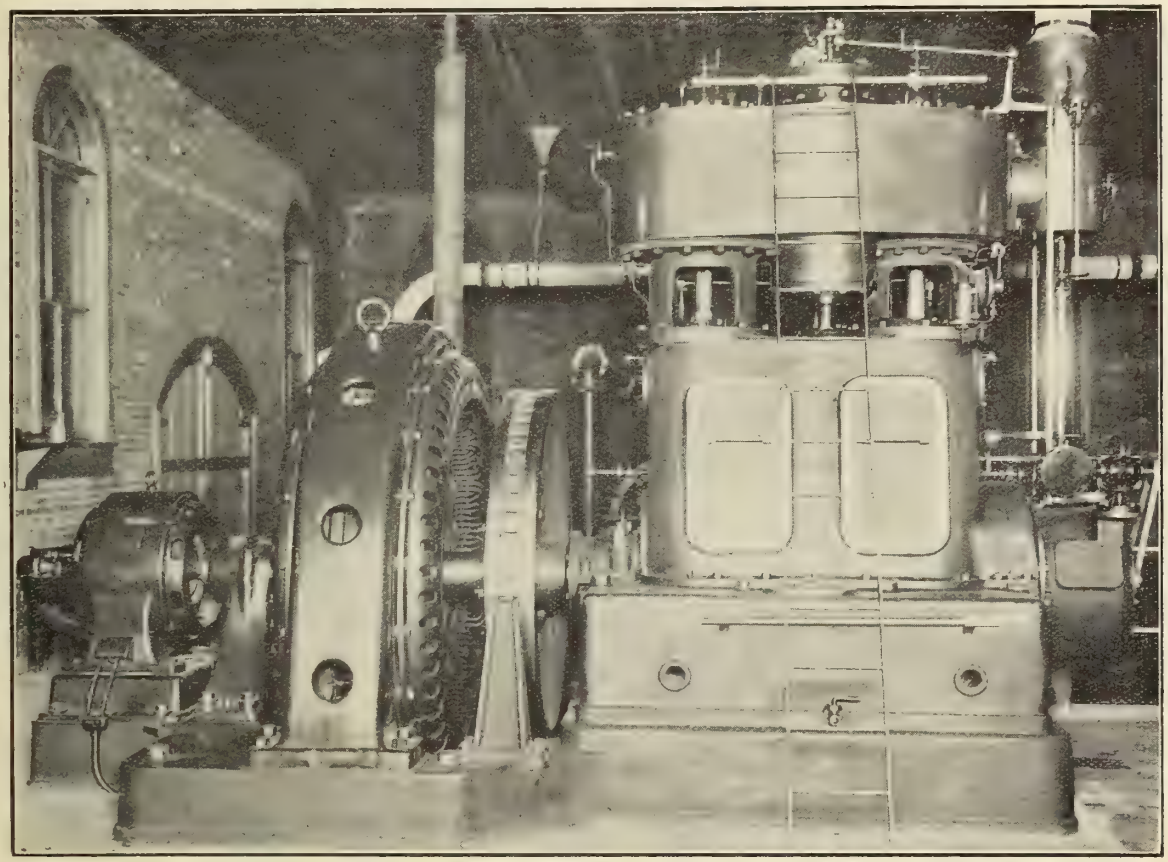
Architect - - - -	A. M. Jeffers, Edmonton
Engineer - - - -	James McAlear, Chicago
Electrical Contractors - -	Cunningham Electric Co., Calgary

Address enquiries to nearest office—Montreal—Toronto—Winnipeg

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Limited, Calgary and Vancouver.

"ADANAC," "IMPERIAL HIGRADE" and "30% PARA"

High Grade Electrical Apparatus



375 K.V.A. 2300 volt, 2 phase, 60 cycle, 360 R.P.M., A.C. generator direct connected to a Belliss & Morcom high speed engine supplied to the corporation of Wetaskiwin, Alta.

Kilmer, Pullen & Burnham,

LIMITED

Head Office,
TORONTO

Branch Offices: MONTREAL
General Supplies Ltd.,
CALGARY, ALTA.

SOLE DEALERS FOR

The General Electric Co., of Sweden

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The Best Endorsement of the value of the "Electrical News" as an advertising medium is the above List of Advertisers



HEAD OFFICE, BANK OF TORONTO, TORONTO, ONTARIO.

A "GALVADUCT" Building

GALVADUCT

"GALVADUCT"

The most perfect interior construction conduit on the market.
Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

LORICATED

Conduits Company Limited.

Toronto - Montreal

The Canadian Porcelain Company, Limited

HAMILTON, - ONTARIO



Cut shows new plant recently completed and now in operation.

We wish to announce our readiness to tender on your insulator requirements.

Our plant is modern in every respect embodying the best European and American practice in arrangement and methods.

Our plant is in charge of experienced insulator specialists.

—: STOP :—

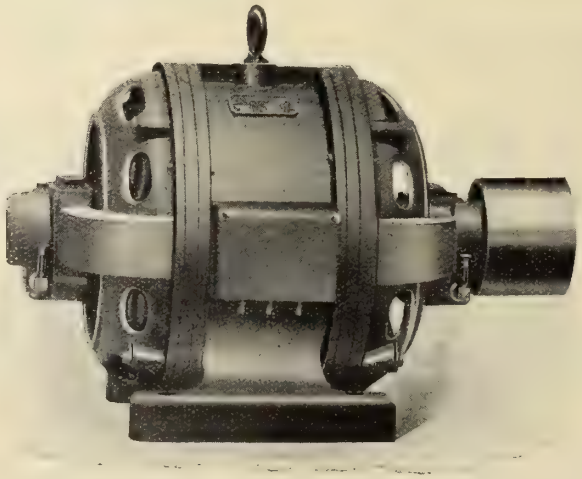
That's what you must do to read the following remarks, **BUT** it's what the **UNION** Motor **NEVER** does when once started and the current is kept on.

Learn all about it by asking for our Bulletins.

Canadian Union Electric Co., Limited

Head Office: 130 Wellington St., West, Toronto

Also at 9 St. Nicholas St., Montreal



Pattern H. D. Squirrel Cage Motor.

Represented in Winnipeg by:

The Mainer Electric Co., Limited

61-63 Albert St.

G. M. Gest

Conduit
Engineer & Contractor

503 Power Building, Montreal, Can.



NEWTYPE
BERGMANN
LAMPS

(*Tungsten Filament*)

The Unbreakable Kind

Are Now Ready for Delivery

We guarantee delivery to you in good condition

EXCLUSIVE CANADIAN DISTRIBUTORS

P. H. KLEIN CO., LIMITED

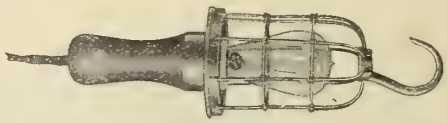
23-25 DOWD STREET, MONTREAL, P.Q.

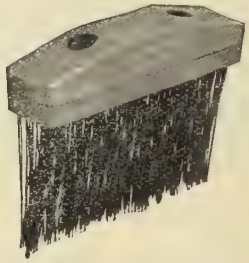
LIVE AGENTS WANTED ALL OVER CANADA



Keystone Sand Driers


Electric Car Heaters


Keystone Lamp Guards


Wire Switch Brooms


Sleet Scrapers




Sleet Wheels

Adjustable Track Brushes

Get Your Snow Fighting Equipment Now

How about that next snow storm?

Yes, it may tie up your whole system; it may cause a lot of inconvenience to your patrons; it may cost you a lot of money.

Why not catch it in time? Why not place yourself in a position to handle it? Why not forget all about the trouble and loss it may cause you?

You can do this if you act **now** and get proper snow-fighting equipment to handle your conditions.

Keystone Snow Fighting Equipment

has long been recognized as the **quality snow-fighting equipment.** Such articles as

Track Scrapers **Sand Driers** **Track Brushes**
Electric Car Heaters **Sleet Wheels** **Safety Car Step Treads**
Sleet Scrapers **Rattan and Bamboo Switch Brooms**
Car Replacers **Wire Track Brooms** **Snow Sweeper Rattan**

have been designed to meet just the conditions a system is up against with a heavy fall of snow. And that they **do meet them** is evidenced by the hundreds of electric railway properties now using them.

You can get this equipment at a cost which is insignificant compared to the loss that would be met by even one tie-up on your system.

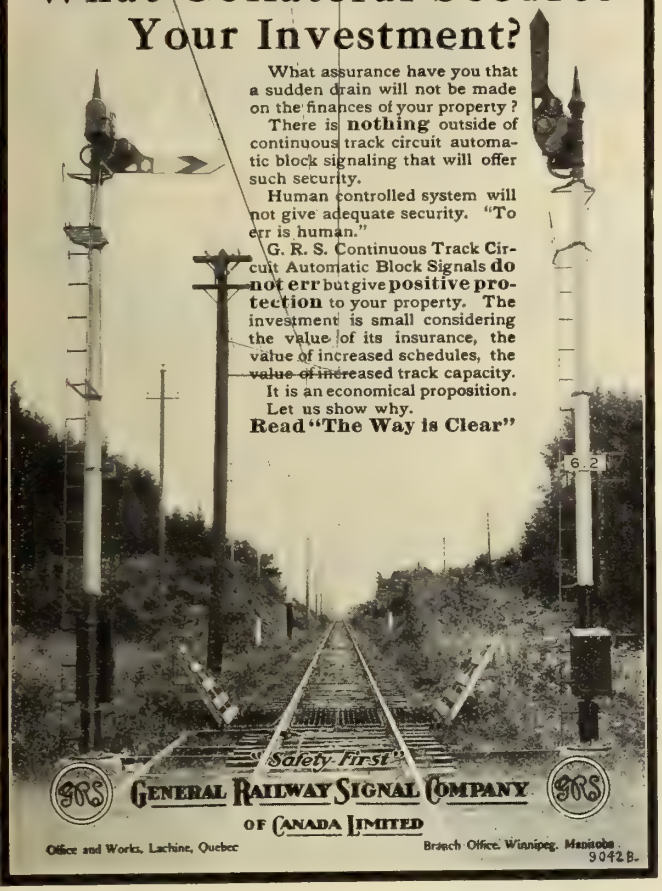
Do not delay on this vital matter. Your prompt action now in getting your property fully equipped may mean all the difference between your cars running through the next snow storm, or being partly or completely tied up.

Write us about it now !

JOHN MILLEN & SON, LIMITED
Canadian Distributors
TORONTO MONTREAL WINNIPEG VANCOUVER

ELECTRIC SERVICE SUPPLIES CO.
Manufacturers
PHILADELPHIA 17th and Cambria Sts.
NEW YORK Hudson Terminal
CHICAGO 417 So. Dearborn St.

What Collateral Secures Your Investment?



What assurance have you that a sudden drain will not be made on the finances of your property?

There is **nothing** outside of continuous track circuit automatic block signaling that will offer such security.

Human controlled system will not give adequate security. "To err is human."

G. R. S. Continuous Track Circuit Automatic Block Signals **do not err** but give **positive protection** to your property. The investment is small considering the value of its insurance, the value of increased schedules, the value of increased track capacity.

It is an economical proposition.

Let us show why.

Read "The Way is Clear"

"Safety First"

GENERAL RAILWAY SIGNAL COMPANY OF CANADA LIMITED

Office and Works, Lachine, Quebec — Branch Office, Winnipeg, Manitoba

9042B.

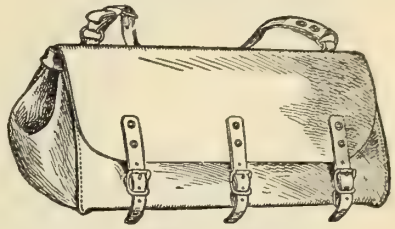
A Practical XMAS Gift

Is a Good TOOL BAG

Dealers should stock up at once.

Inspectors' Russet Leather Bag

Made of good strong leather with extension ends and shoulder strap. Has saw receptacle. Sizes 16, 20 and 24 inches in length.



Inspectors' Black Leather Bag

Made of black harness leather. Strong and substantial. 15 and 20 inches long; height 12 inches.



Linemen's Heavy Canvas Bag

Has harness leather bottom studded with clincher studs that go through and clinch on the inside. Strong steel frame with heavy canvas sides. Length, 20, 16 and 12 inches.



Get our dealers proposition on the subject of interest to you. Write also for 96-page illustrated catalogue.

Mathias Klein & Sons
Canal Sta. 59
CHICAGO, ILL.

You Need Them in Stock



Illustration showing No. P & S 42 mounted on one of the standard 4 inch outlet boxes.

A wide variety of uses is permitted with P & S 42. It may be used as a wall receptacle or it may be used on 3¼ inch boxes or on 4 inch boxes.

Packed in a neat paper carton and each carton contains the screws with which to fasten the receptacle to either of these sized boxes.

PASS & SEYMOUR, INC.

MAIN OFFICE AND WORKS:

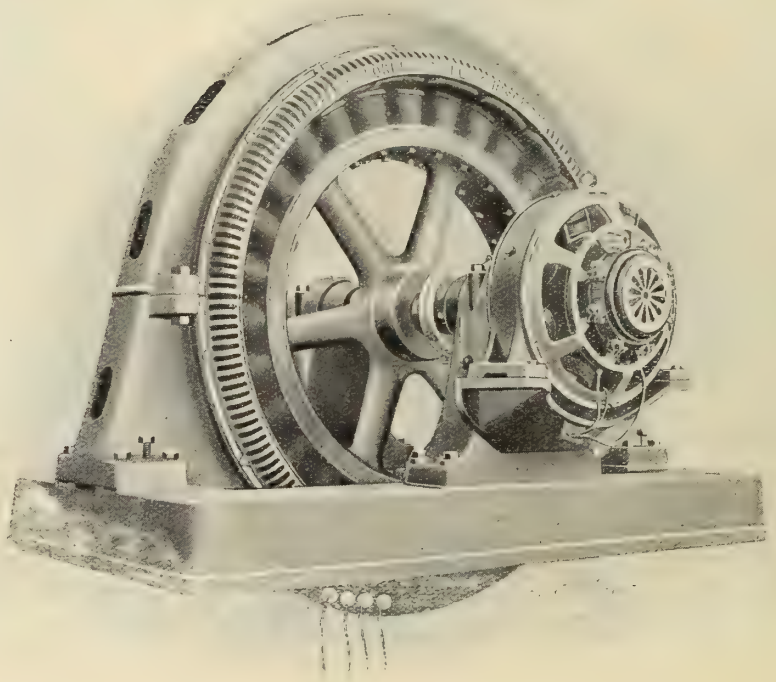
Solvay, New York, U.S.A.

San Francisco—Rialto Building.

Swedish Electrical Machinery

Noted for

Efficiency and Workmanship



550 K.V. A. 60 cycle, 3 phase, 3300 volt, 240 R. P. M. water wheel driven Generator with direct connected exciter.

We solicit your specifications for Electrical Equipment

BURNHAM ENGINEERING COMPANY

LIMITED

Canadian Dealers for

The Amalgamated Electric Company of Sweden

Head Office:
Traders Bank Building,
TORONTO

Montreal Representatives:
Rudel Belnap Machinery Co., Ltd.
Canadian Express Bldg.

"EUREKA" ELECTRIC CLEANER



Thoroughly reliable and absolutely guaranteed. Sold at a moderate price with a good profit to the dealer.

Write for particulars and agency.

Onward Manufacturing Co., Berlin, Ont.

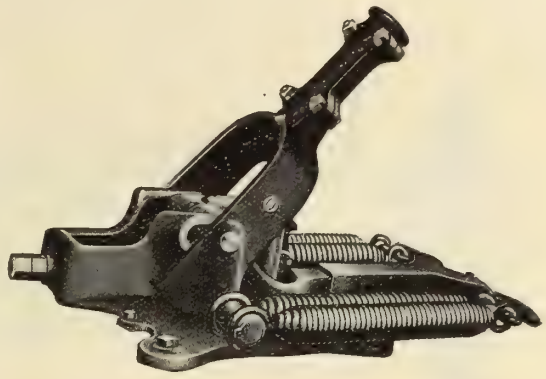
ASK US about Efficient Lighting

for your streets, factory, warehouse or yard

A. H. WINTER JOYNER, Ltd.

76 Bay Street, Toronto

"Consult A Specialist"



For Long Service O-B Trolley Base

Uniform thrust on bearings and freedom from binding prevent rapid wearing of parts.

Furthermore, wearing parts are removable and may be easily replaced.

See pages 388-389 of Catalog No. 12

The Ohio Brass Company

Mansfield, Ohio. U. S. A.

A SILCOR TUMBLE

Beats The Balls Buffer, Sand Blast

And all other devices for polishing

THE HIGHEST AND CHEAPEST LUSTRE AND IN EVERY TINY CORNER

TENDER WITH THE MOST DELICATE BUT CUTS THE HARDEST STEEL BRASS, NICKEL, CAST IRON, GERMAN SILVER, STEEL—ANY METAL

Small Plants—Five dollars' worth of "SILCOR" and an improvised barrel will save most all that hand labor.
Large Plants—Dispense with hand labor and roll both tiny and huge pieces in "SILCOR."
Holding a piece to a buffer is as illogical as turning the buffer by hand. Let the Power roll it in "SILCOR." "SILCOR" will find every spot.
It costs so little to polish by tumbling with "SILCOR" that no piece ought to leave your plant unpolished.
Send 10c and parcel postage for sample pound and shake some of your pieces in a tin can. Then send for a barrel load.

Corundum Products Company

Spokane, Washington, U. S. A.

Ornamental
Luminous Arc Lamps
Make the "City Beautiful."



White Way Type

ONE of the first aids towards bettering conditions in a city and making it attractive is good light in the streets.

The Ornamental Luminous Arc Lamp does both. The brilliant, soft, white light from these lamps besides illuminating the sidewalks and streets, lights up the adjacent buildings, so that the architectural details are brought out and locations of business offices are not wholly lost when evening falls.

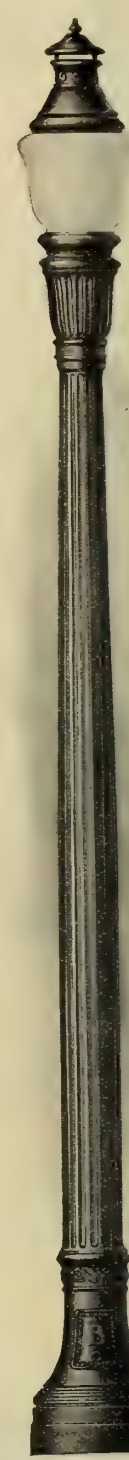
Further, the appearance of the streets by day is made attractive by these handsome and artistic lighting units.

Hundreds of progressive cities have installed these Ornamental Luminous Arc Lamps which are fast becoming the accepted system of ornamental street lighting.

THREE TYPES ARE MADE:

The "WHITE WAY" for White Way lighting.
The "RESIDENTIAL" for Residence districts.
The "PARKWAY" for Boulevards and Parks.

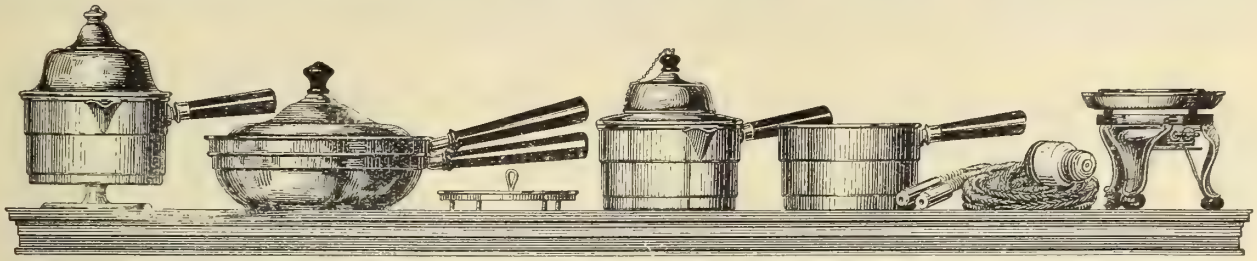
¶ Write for our handsome bulletin No. 4955 on Ornamental Luminous Arc Lamps.
¶ The request entails no obligation on your part.



White Way Type

CANADIAN GENERAL ELECTRIC CO.
LIMITED
Head Office: TORONTO
District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

THE IDEAL GIFT



With these parts, *one* electric stove makes a set of five electric utensils—$25.00 complete.



Uni-Set Stove, $8.00.

Announcing The Uni-Set

This is the first real electric cooking set of its kind at a moderate price. It is a compact, **practical** table cooking outfit.

For the moderate purse, the Uni-Set Stove with Chafing Dish or any other single device is the start—the other Uni-Set parts shown here may be purchased separately from time to time, to complete the set.

This new Uni-Set, with the conveniences of electric cooking and the advantage of building up the set, is being advertised in over four million copies of such well-known magazines as the Saturday Evening Post, Delineator, Woman's Home Companion, etc., during December.

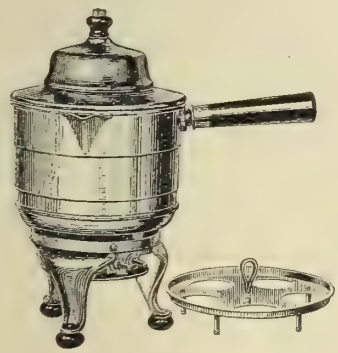
The Uni-Set will be one of the most popular sellers of the holiday season.

Send your order in today.

Prices shown are list.

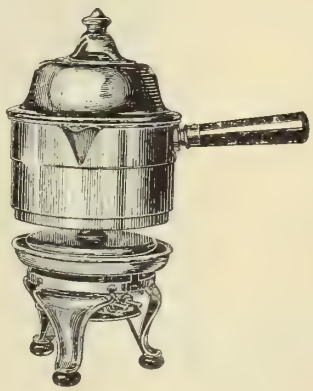


Uni-Set Chafing Dish, $12.00.

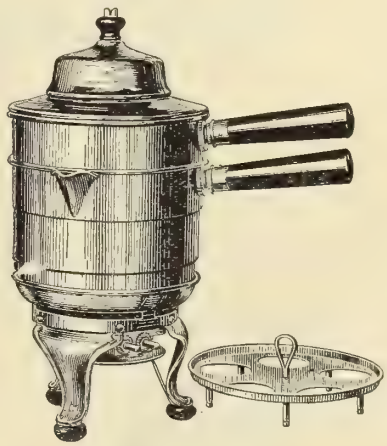


Uni-Set Tea Samovar, $13.50.

The Samovar cover has a central opening adapting it for use as a baby milk warmer. An egg rack is also included.



Uni-Set Percolator, $15.00.



Uni-Set Nursery Outfit, $16.00.

The nursery outfit is made up of the Samovar and an inner vessel, converting it into a double boiler.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert.

GMUR & COMPANY, LIMITED

Aarau, Switzerland

CAPITAL $ 200,000

Carbon Filaments in all Shapes and Sizes **Flexible Metal Filament "Uranit"**

Drawn Light Wire "Uranit" **Supports** **Carbon, "Uranit" Alloy Molybdenum, Molybdenum Alloy**

Tungsten-Molybdenum Wire in all Sizes

LARGEST SPECIAL FACTORY FOR LAMP FILAMENTS

Goods manufactured by

The Canada Metal Co., Limited

Have a Reputation for Quality

IMPERIAL SOLDERING PASTE

Absolutely the finest soldering paste on the market.

IN TINS
2 oz.
4 oz.



IN TINS
8 oz.
1 oz.

A Sample Order will convince you that we have reason to be proud of the goods we manufacture.

We have 5,000 2 oz. tins to give away as free samples. Send us your name and address to-day and receive one *Post Paid*.

Manufactured by

The CANADA METAL CO., LIMITED

TORONTO

Branch Factories: MONTREAL and WINNIPEG

Continuous Track Circuit — the basis of the only always-safe Signal System

as applied in the light of all the experience, skill and knowledge which have developed the

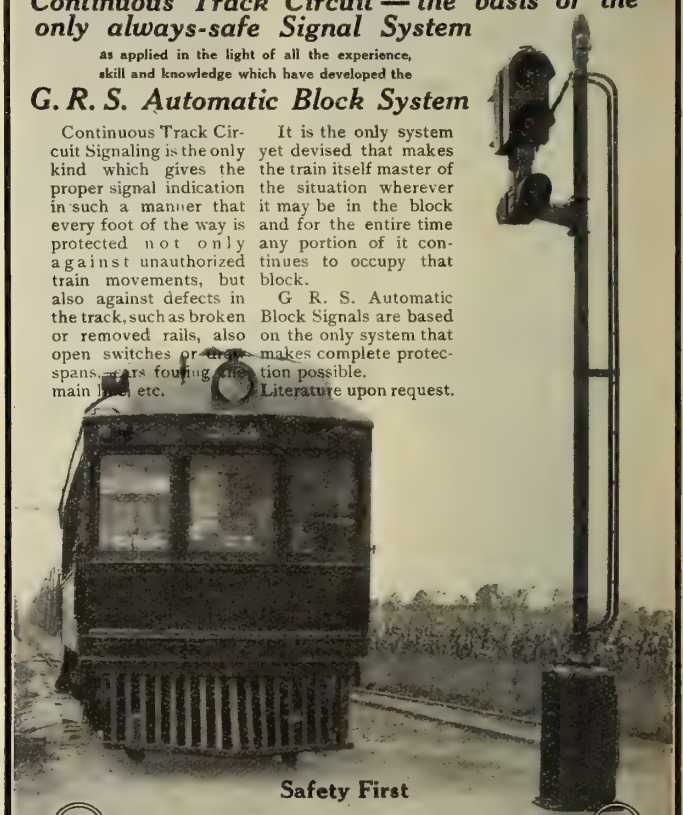
G. R. S. Automatic Block System

Continuous Track Circuit Signaling is the only kind which gives the proper signal indication in such a manner that every foot of the way is protected not only against unauthorized train movements, but also against defects in the track, such as broken or removed rails, also open switches or drawspans, cars fouling the main line, etc.

It is the only system yet devised that makes the train itself master of the situation wherever it may be in the block and for the entire time any portion of it continues to occupy that block.

G. R. S. Automatic Block Signals are based on the only system that makes complete protection possible.

Literature upon request.



Safety First

GRS GENERAL RAILWAY SIGNAL COMPANY GRS

OF CANADA, Limited

Office and Works Lachine, Quebec.

Branch Office Winnipeg, Man.

Yager's Soldering Fluxes

4 Forms—1 Result—The Perfect Joint

Efficiency is the word. Let us co-operate with you to increase the efficiency of your service. Use Yager's Fluxes in any of the four convenient forms — Salts—Stick—Paste — Fluid, to produce joints which will not fail you at the critical moment. No acid in any of them. They make the perfect electrical joint.

Write now for sample and discount.



ALEX. R. BENSON COMPANY

HUDSON, N. Y.

SIMPLEX EQUALITY

The Year-Round Merits of Simplex Products make our Holiday Offerings Self-Sellers.

You can't well overstock on Simplex goods—they are always first choice.

We have greatly enlarged our popular Simplex line with new offerings of specially attractive lamp socket devices. They give you a nice profit margin, and have a strong selling appeal. Special holiday packing.

Descriptive Matter is Now Ready

SIMPLEX ELECTRIC HEATING CO.

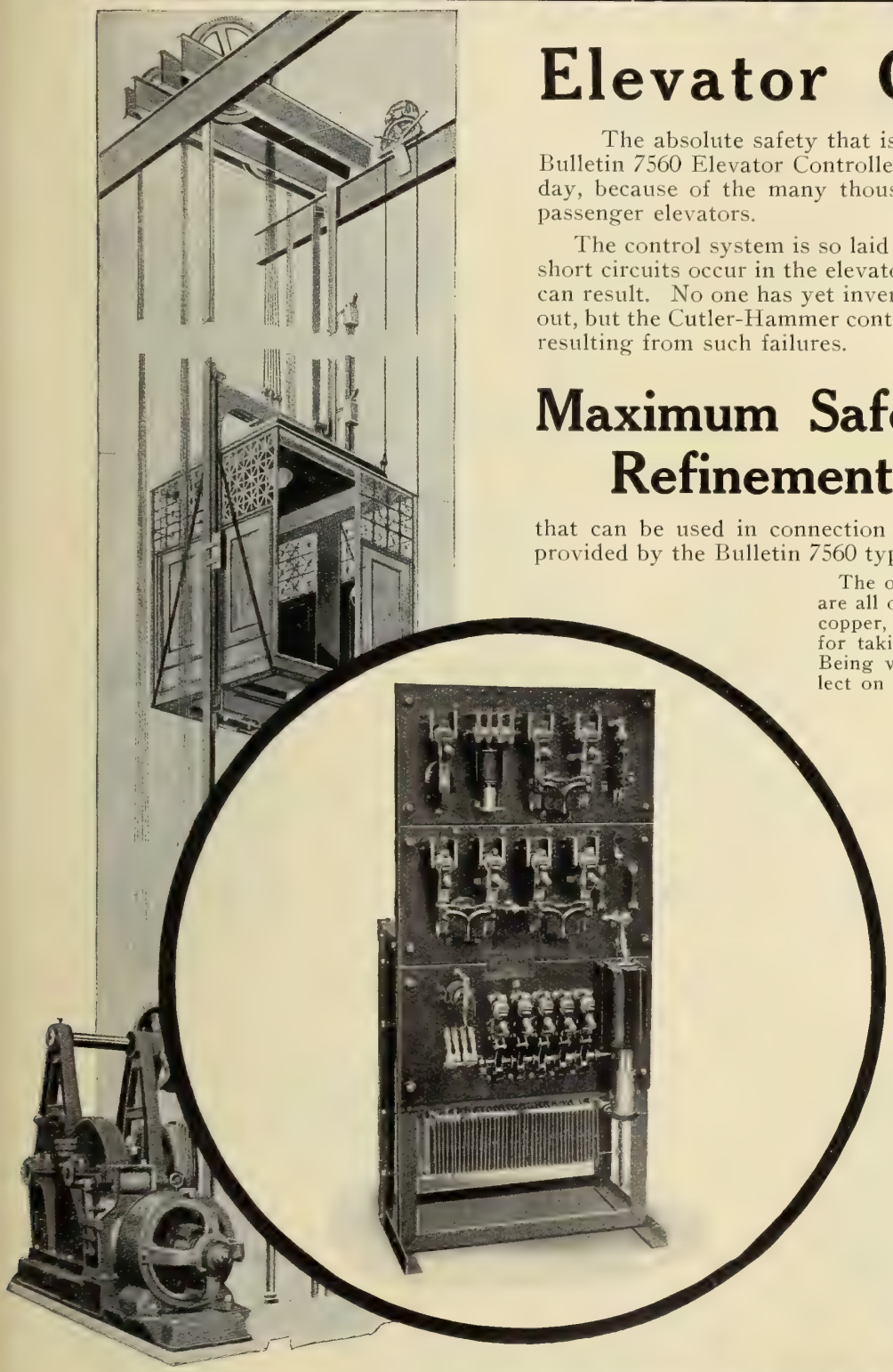
Mfrs. of Everything for Electric Heating and Cooking

BELLEVILLE, ONT.

CHICAGO, 15 S. Desplaines St. CAMBRIDGE, MASS.

SAN FRANCISCO, 612 Howard St.

CUTLER-HAMMER



Elevator Controllers

The absolute safety that is insured by the Cutler-Hammer Bulletin 7560 Elevator Controller is of most vital importance today, because of the many thousands of people carried daily in passenger elevators.

The control system is so laid out that even should grounds or short circuits occur in the elevator cables or switches, no damage can result. No one has yet invented a cable that will never wear out, but the Cutler-Hammer control system eliminates any danger resulting from such failures.

Maximum Safety and Every Refinement of Control

that can be used in connection with direct current motors are provided by the Bulletin 7560 type controller illustrated below.

The operation is very quiet, the contracts are all of the vertical butt "type," carbon to copper, with a wide range of adjustments for taking up wear and giving a long life. Being vertical, dust and dirt does not collect on them.

The Important Features are:

1. Safety.
2. Refinement of control.
3. Quiet operation.
4. Main line magnetic switch is double-pole, breaking both sides of the line.
5. Vertical "butt" carbon to copper contacts insure long service and do not collect dust or dirt.
6. All parts and connections accessible.
7. Rugged construction.
8. Overload device automatically reset by throwing car switch to off position, making it possible to set this overload within the closest limits.

Controllers for all Types of Elevators

are made, including those for heavy freight and those of the highest speed passenger type.

Booklet containing complete set of Elevator Bulletins sent to those interested.

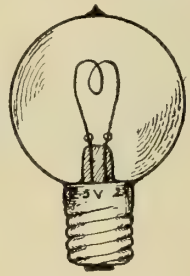
THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK: Hudson Terminal 50 Church Street CHICAGO. Peoples Gas Bldg. PITTSBURG: Farmers' Bank Building
BOSTON: Columbian Life Bldg. PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Building
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St., SAN FRANCISCO, 229 Sherlock Building, PORTLAND, ORE.
and W. B. Palmer, 416 East 3rd St., LOS ANGELES.

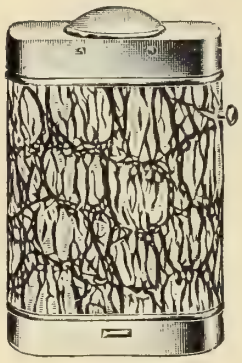
Your Best Profits

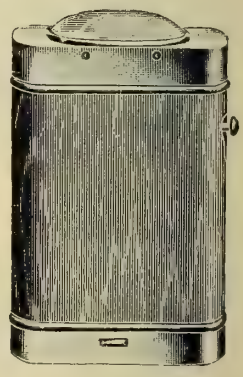
are made on Seasonable Goods—each day increases the demand for these flash lights.

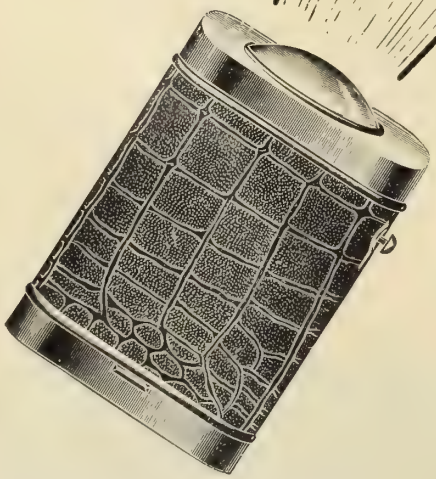
LAMPS
for Flash Lights
Auto Head Lights, etc.



We have a large assortment of sizes in Edison Screw or Bayonet bases







If you have not yet put in your stock of these Flash Lights do so at once. We can supply you with any quantity or assortment at short notice.

We have a large stock of miniature low voltage tungsten lamps from which we can make prompt shipment.

Write for our prices

Chapman & Walker

Limited

120 Richmond Street West

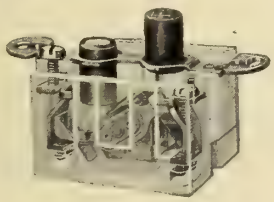
Toronto **Ontario**

From Coast to Coast "ARROW E" Switches are installed in Canada's Prominent Buildings

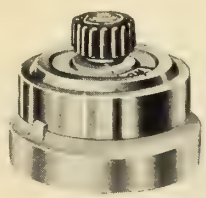


Following are some of the buildings equipped with "ARROW E" Switches:

HALIFAX	Post Office Building
ST. JOHNS	Imperial Theatre
QUEBEC	Canadian Bank of Commerce
MONTREAL	Shaughnessy Building Gravelle Building Royal Trust Building
TORONTO	Imperial Optical Building Sunbeam Lamp Co. Building
WINNIPEG	Sterling Bank Office Building Bank of Commerce Manitoba Free Press Building
BRANDON	Prince Edward Hotel Brandon Asylum
SELKIRK	Selkirk Asylum
SASKATOON	Canada Building
CALGARY	Anderson Apartments Sherman Grand Theatre
VANCOUVER	World Building Vancouver Block
VICTORIA	Pemberton Building R. V. Winch Building



Push Button Type.



Surface Type.

DURABLE — SMOOTH-ACTING — QUIET — GUARANTEED

Canadian Distributors:

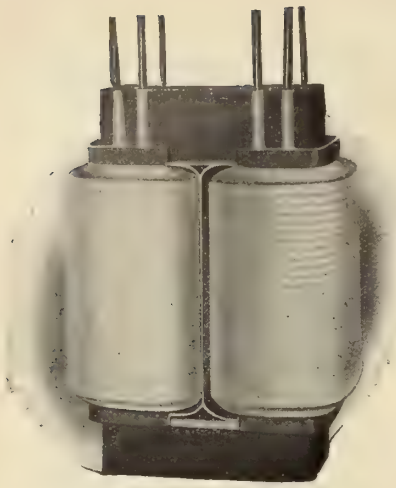
THE Northern-Electric AND MANUFACTURING CO. LIMITED

MONTREAL
REGINA

HALIFAX
CALGARY

TORONTO
EDMONTON

WINNIPEG
VANCOUVER



Low Temperature Rise

THE extremely low temperature of rise of Moloney H. E. Transformers prevents the deterioration of the insulation, also the ageing of iron, and therefore removes the limitation of output.

Copper coils are outside of the core, causing the heat of the coils to be easily and rapidly dissipated outward in a constantly increasing circle to the exterior of the transformer case.

The maintenance of low temperature in Moloney transformers effects a great saving in their operation and maintenance.



Write for the Moloney Catalogue

Canadian Moloney Electric Company, Limited

WINDSOR, ONTARIO

Factories at Windsor, Ont. and St. Louis, Mo., U. S. A.

825 Vancouver Block, Vancouver B. C., Canada
901 New Electric Railway Chamber, Winnipeg, Man., Canada
1001 C. P. R. Building, Toronto, Ont., Canada

Complete stocks carried at Windsor, Winnipeg and Vancouver



VULCABESTON

In Its World Wide Reputation For Excellence

continues to solve the most difficult problems on Moulded Insulation. It has no equal from the standpoint of electrical and mechanical strength, heat and moisture proof qualities, or extreme temperature conditions.

We are prepared to meet any condition of service where Moulded Insulation is required and offer the best Engineering and Manufacturing facilities in the world.

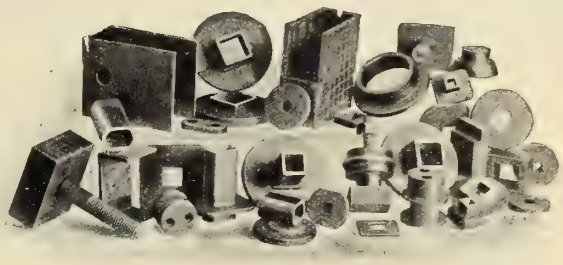
Write our nearest House for Catalog No. 15

The Canadian
H. W. Johns-Manville Co., Limited

Manufacturers of Asbestos and Magnesia Products — ASBESTOS — Asbestos Roofings, Packings, Electrical Supplies, Etc.

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1848 A



Sundh Sump and Tank Switches

are the Simplest and Strongest

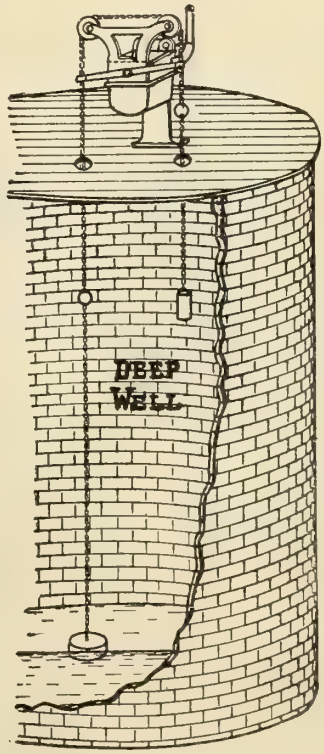
Unequalled for controlling water levels in tanks wells or sumps.

Absolutely weather proof and will perform their duty with reliability.

Furnished single, double, three or four pole. Always give a quick, sharp make and break.

"Sundh" Switches, Panels and complete line of Controlling Devices described in our catalogue.

Send for one to-day.

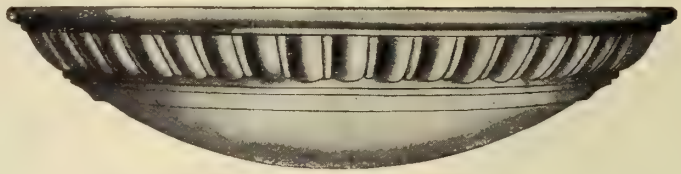


Sundh Electric Company

NEW YORK, U. S. A.



No. 1050 Shefield Electric



No. 6020 Moonstone Semi-Indirect Unit



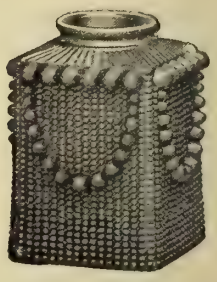
No. 5000 Pressed Electric

Moonstone Glass

In stock ready to ship at all times, Reflectors, Hemispheres, Spheres, Canteloupe Balls, Grecian Lanterns and Semi-Indirect Bowls which are also finished in Old Ivory, Bronze, Verde Green and Pink.



No. 984 Pressed Electric



No. 2658 Pressed Jewel Electric

Crystal Glass

In Electrics, RI or RO; Ball Globes, 4″ to 18″ dia.; Squat Ball Globes, 6″ to 10″ dia.; Squat Ceiling Bowls, 10″, 12″ and 14″ dia.; Ceiling Bowls, 7″, 8″, 10″, 12″, 14″ and 16″ dia.; Clear Ribs; Cylinders and Bell Electrics.

We are now prepared to furnish cut shades and balls in all styles of cuttings.



No. 974 Paneled Electric



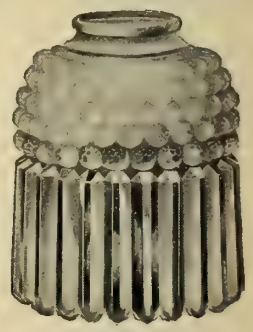
No. 1045 Bell Blectric



No 1002 Electric



No. 6024 Semi-Indirect Unit



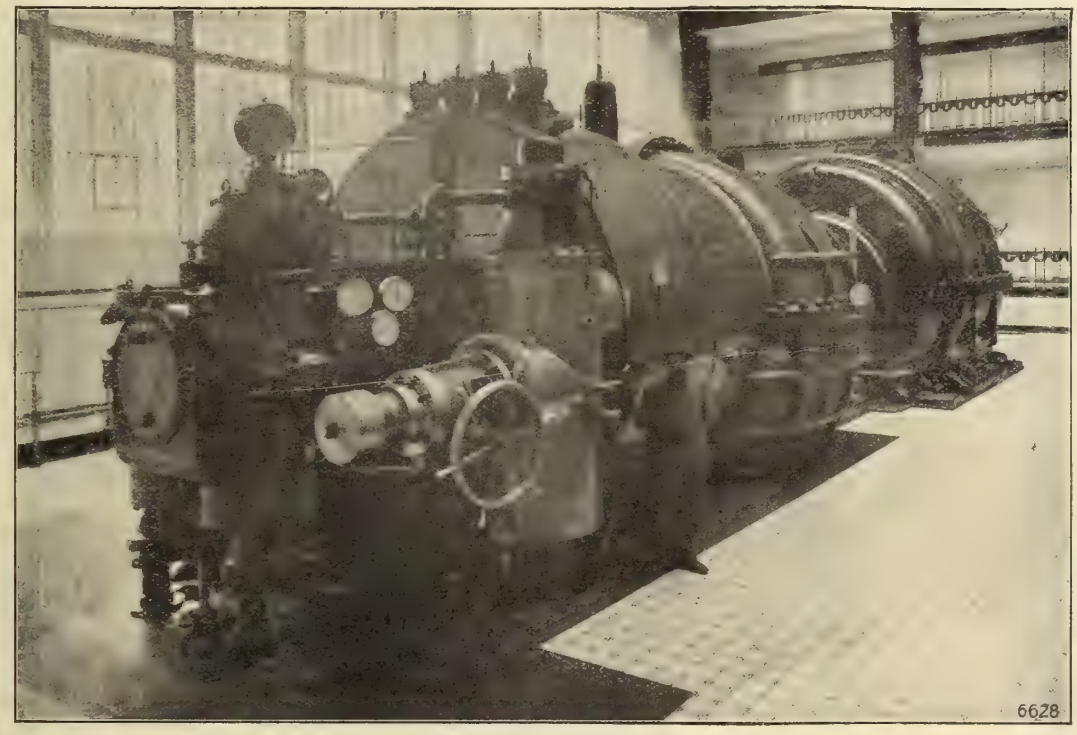
No. 2655 Prism and Jewel Electric

The Jefferson Glass Company Limited

MADE IN CANADA

TORONTO CANADA

THE BROWN, BOVERI
IMPULSE-REACTION STEAM TURBINE



20,000 K. W. Brown, Boveri Steam Turbo Alternator Unit.

Manufactured for outputs from 100 K. W. up to the largest size and embodying

BEST DESIGN AND WORKMANSHIP **LOW STEAM CONSUMPTION**
GOOD REGULATION **THOROUGHLY RELIABLE OPERATION**

Also **BLEEDER TURBINES** for the special requirements of:—

PULP AND PAPER MILLS **CHEMICAL FACTORIES**
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and all manufacturing processes requiring both electrical power and low pressure steam.

We can supply *Complete Turbo Units*:—Including Turbine, Direct Current or Alternating Current Generator, Turbo Blower or Compressor, Condenser and Pumps.

For particulars address

THE CANADIAN CROCKER-WHEELER CO., LIMITED
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Where QUALITY counts in

WIRES

AND

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SPECIFY  BRAND

BARE and INSULATED WIRES,
RAILWAY and POWER FEEDER CABLES
in Copper or Aluminum.
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Stocks of wire and cables carried at Toronto, Montreal, Winnipeg and Vancouver.

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See to it that you get your share of the Xmas Business.

Make your window work. Trim it with Xmas present suggestions — Household Appliances — Colored Electric Lights— Eveready Flashlights!

We are prepared to help you.

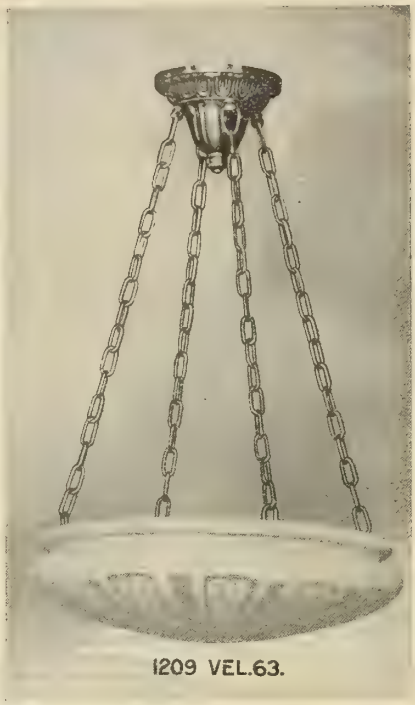
At each of our houses we carry a complete stock of all these lines.

We guarantee prompt shipments.

THE Northern Electric AND MANUFACTURING CO. LIMITED

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Calgary Edmonton Vancouve Victoria





Beautiful and Efficient Semi Indirect Bowls

"Veluria" "Calla" "Sudan"

The three most beautitul of white glasses.

Veluria Toned

"Ivory," Golden Bronze and Light Green

Bracket and fixture globes to match.

The Holophane Co., Limited, Toronto

Holophane a Toronto Product.

The Holophane Realite the Commercial Lighting of Today.

Our stock of

FIXTURES

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New, Complete and Up-to-date

Consequently we can take good care of your fixture requirements.

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The Mainer Electric Co., Limited

Winnipeg **Edmonton**

The largest Electrical Supply House in the West

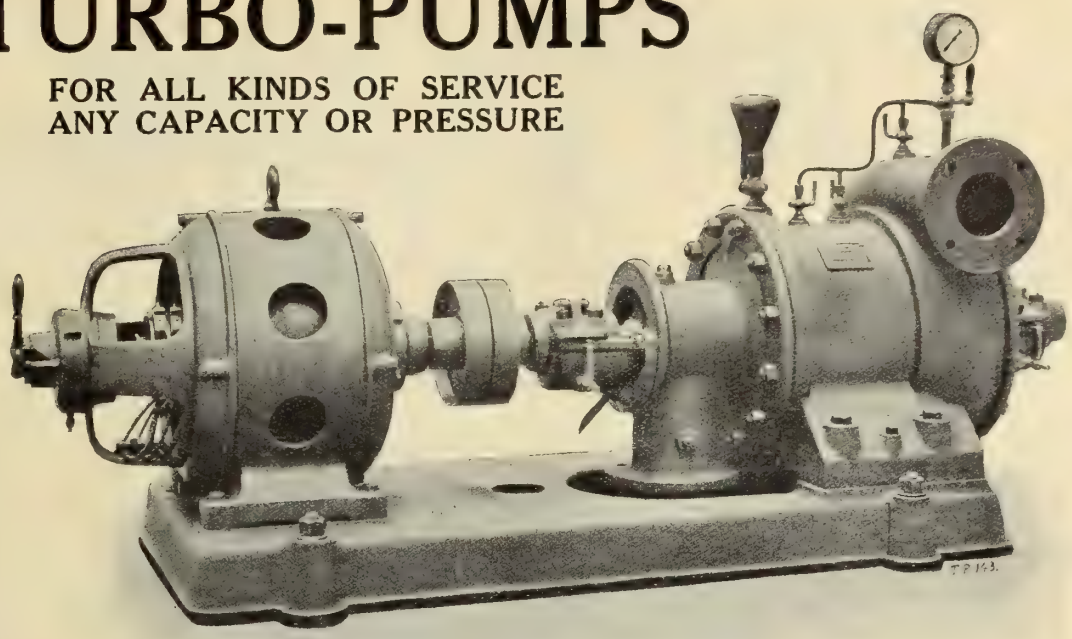
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FOR ALL KINDS OF SERVICE
ANY CAPACITY OR PRESSURE

Highest Efficiency

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Greatest Reliability



ESCHER WYSS & CO.

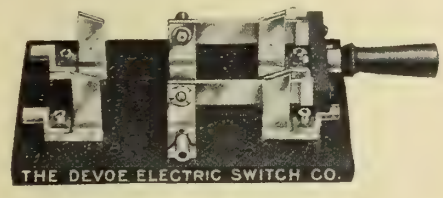
HEAD OFFICE FOR CANADA:
626-627 Coristine Bldg., Montreal, Que.

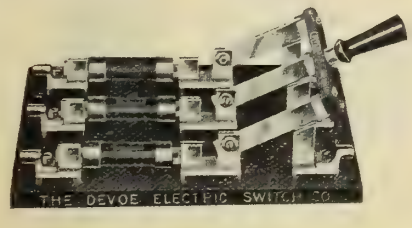
The Devoe Electric Switch Company

MANUFACTURERS

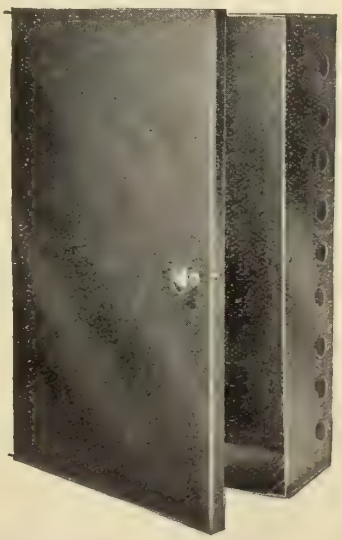
We design and manufacture SWITCHBOARDS, PANELBOARDS, CABINETS, SWITCHES and IRON BOXES of every description.

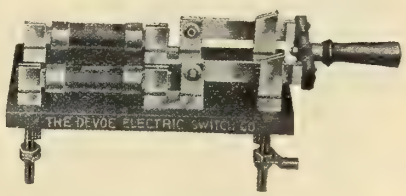
Quotations promptly made upon request when drawing or sufficient data are submitted.

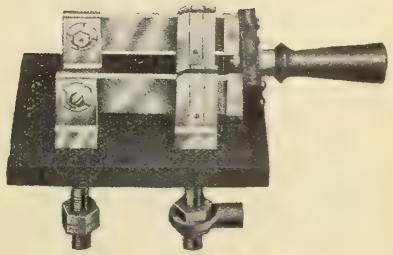




Write for Switch Catalogue No. 6 and Box Bulletin No. 2.







Send us your Specifications.

Office and Factory: No. 157 Craig St. West, Montreal

Frank G. Scofield, Ontario Sales Representative, Lumsden Building, Toronto, Ontario

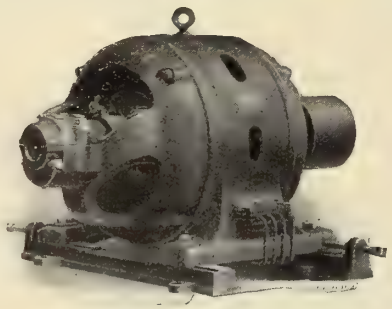
PUT $\frac{ONE}{E}$ = "STUNG"

Put One Over the Engineer

When he specifies a four pole I-T-E Circuit Breaker, give him a cheap two pole circuit breaker and a four pole switch, and tell him that's your standard practice. To avoid being "stung" specify I-T-E and stick to it.

THE CUTTER COMPANY, Philadelphia

Have You Seen Our New Single-Phase Bulletin?



Standard Wagner BA type Single-Phase Motor with side rails and pulley.

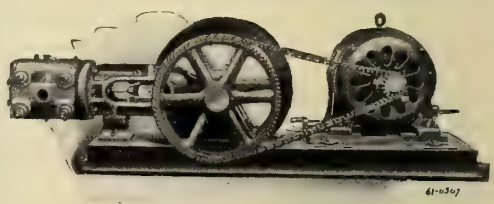
It describes the most complete line of single-phase motors ever produced. A type of alternating current motor for every purpose is the slogan of the Wagner Company.

Our single-phase standard type motor (repulsion starting, induction running) is better than ever. Our aim has been to make this the best single-phase motor of this type. Our records of the performances of these motors in service prove that we have succeeded.

When you have need for a single-phase elevator motor or a variable speed motor, consult this new Wagner bulletin, then write for prices.

The new unity power-factor motor described is the last word in single-phase motor building. A wonderful motor of vast possibilities to the central station.

Write for bulletin No. 10113



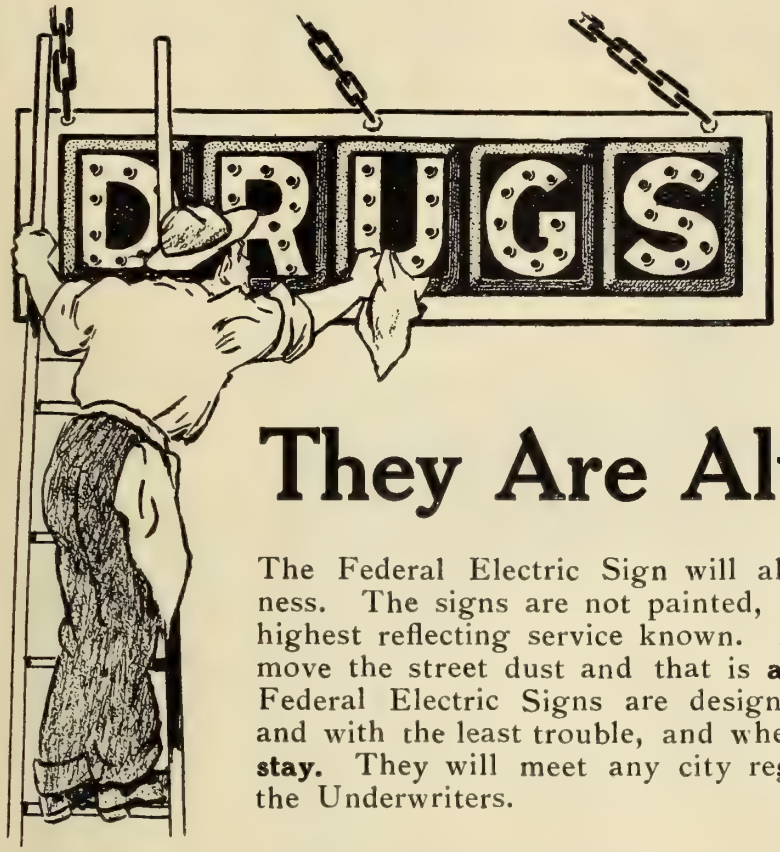
Wagner BA type single-Phase Motor, 5 horse-power, 870 revolutions per minute, driving an Air Compressor.

Wagner Electric Manufacturing Company

of Canada Limited–Montreal

2229

Member of the Society for Electrical Development—Do it electrically.



Federal Electric Signs

They Are Always Bright

The Federal Electric Sign will always retain its original brightness. The signs are not painted, but are porcelain enameled, the highest reflecting service known. A little soap and water will remove the street dust and that is **all** the attention they ever need. Federal Electric Signs are designed to go up in the least time and with the least trouble, and when they are up, they are there to **stay.** They will meet any city regulations and are approved by the Underwriters.

An All Metal Sign That Will Last a Lifetime

The Federal Electric Sign is the result of painstaking planning and construction. It will withstand fire and water and will not rust. The frame is of galvanized channel iron and the sectional plates are stamped upon heavy sheet steel. It is practically indestructible.

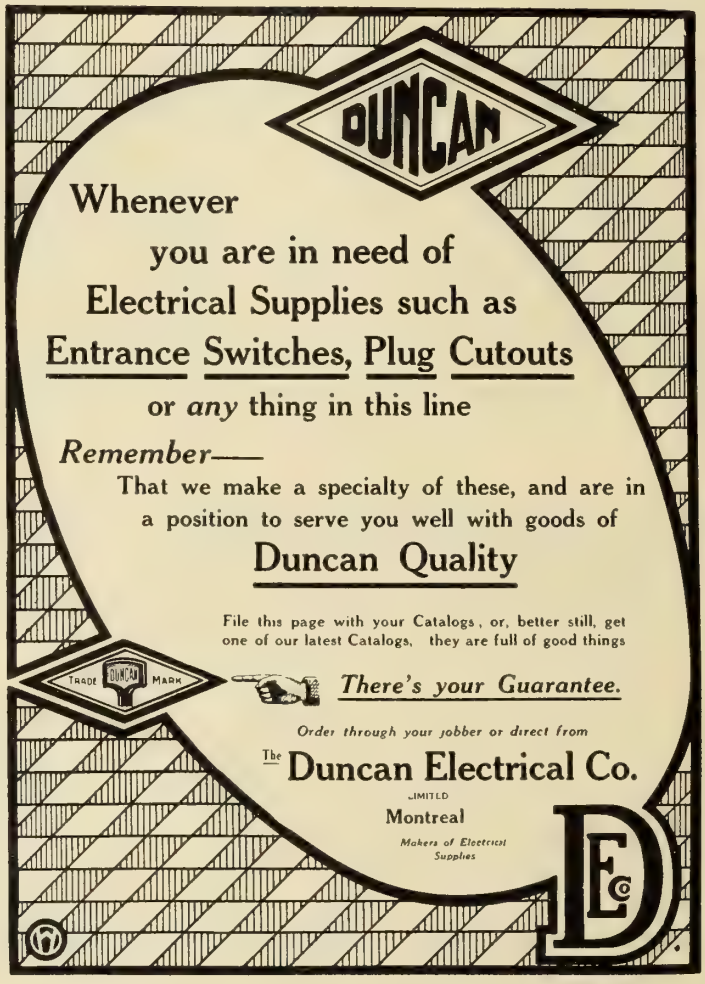
Standard colors are a brilliant white upon a royal blue background, making a sign that is effective and attractive by day or night. The colors are porcelain enameled upon sheet steel and will never lose their brilliancy.

Central Stations Managers will find profit in the Federal.
Bulletin No. 27111 will be mailed upon request.
All Federal Signs sold F.O.B., Factory, Hamilton, Ont.

Federal Sign System (Electric)

Lake and Desplaines Streets
CHICAGO, ILLINOIS

A Good Tip



Have you pasted this in your note book yet? Do it now.

Use the Railway's Trolley Poles



as the basis of your new street lighting system. You can easily convert them into attractive Mazda Lamp Standards or arc lamp supports by use of

ERECO Combination Railway Lighting Pole Fixtures

This system, besides saving you the expense of underground construction, gets the wires up out of the way of traffic, where they are practically unnoticeable and the curb line is not crowded with separate lighting standards.

The progressive railway management will gladly co-operate with you with this object in view.

Design No. 10127.

Electric Railway Equipment Co.

Cincinnati, Ohio

Designers **Manufacturers**

Canadian Representatives:

Dawson & Co., Limited, Montreal, Winnipeg

N. Y. Office, 30 Church St., Hudson Terminal Bldg.



Butler Bros *Chicago*

Another Mammoth Firm Installs the Eye Comfort Lighting System.

Indirect Illumination is the light of the future. It is here to stay.

Many contractors and supply men realize this opportunity and are making big profits as a result. Central Stations are quick to grasp its advantages.

Which is then the most efficient and most economical system? Which is scientifically designed by engineers to produce perfect lighting, and which has been marketed merely to get some of the profits to be made by selling unscientific and inefficient equipment to a public who has not the knowledge to judge intelligently?

Which system shall **you** advocate?

We say to you:—

That the Eye Comfort Lighting System was installed by the Curtis Publishing Company at Philadelphia (1,000 fixtures) after a sixteen months' investigation. Armour & Company equipped their entire five-storey building (900 fixtures) after eight months of testing. Butler Brothers, shown above, light their offices and sample rooms (1,700 fixtures). Boys High School, New Orleans, is installing 1,200 fixtures. The world's largest men's wear store, The Hub, Chicago, is lighted by it throughout (eight stories). The International Harvester Co. has installed 350 fixtures; Sears Roebuck & Co., 700; Montgomery, Ward & Co., 250; Goodyear Tire & Rubber Co., 385 fixtures at Akron, besides thirty branches; and so on.

Millions of capital says "it is the best system, barring none!" This after exhaustive tests costing thousands and much time.

We cannot offer you stronger proof. We know of no more positive proof you can give your customers. Acquaint yourself with the Eye Comfort Lighting System. It is sold by Canadian jobbers. Ask for our data book and catalogue.

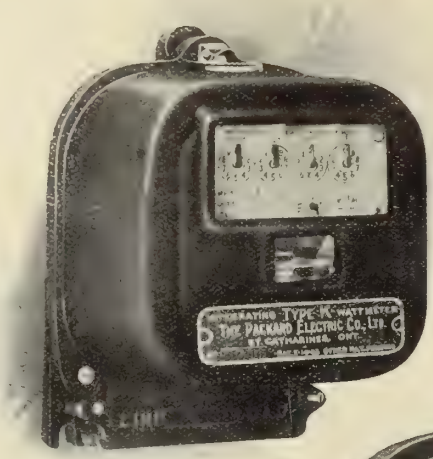
National X-Ray Reflector Co.

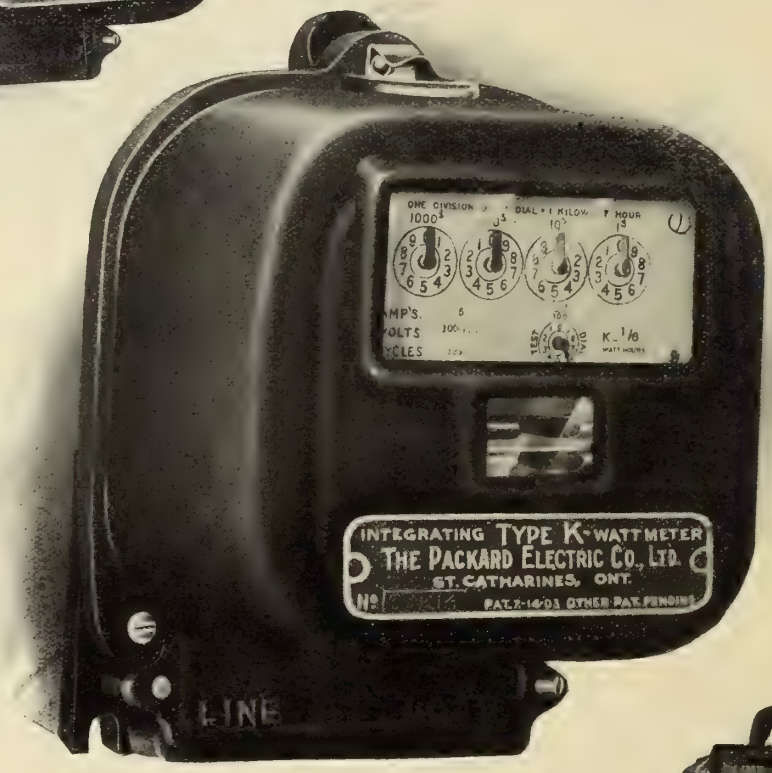
General Offices:
225 W. Jackson Blvd.
Chicago, Ill.

New York Office:
Eye Comfort Lighting Shop
14 W. 33rd. St.

Packard

unexcelled for Accuracy, Reliability and Permanency of Calibration







Large Stocks Carried at

St. Catherines and Winnipeg; St. John Railway Co., St. John, N. B.; General Supplies, Limited, Calgary, Alta.; Rudel-Belnap Machinery Co., Canadian Express Bldg., Montreal, P. Q.

Get our quotations

The Packard Electric Company, Limited

Factory at **ST. CATHARINES, ONT.**

General Sales Office
Traders Bank Bldg., TORONTO

N. W. Office and Warerooms
WINNIPEG

Seasonable Suggestions

For Your

Xmas Trade





Get the Tungstolier Bulletin

IMMEDIATE DELIVERY

The Tungstolier Company of Canada Limited

Head Office:—4th Floor Canadian General Electric Building
Corner Simcoe and King Streets, TORONTO



Cleveland Fare Box Co.

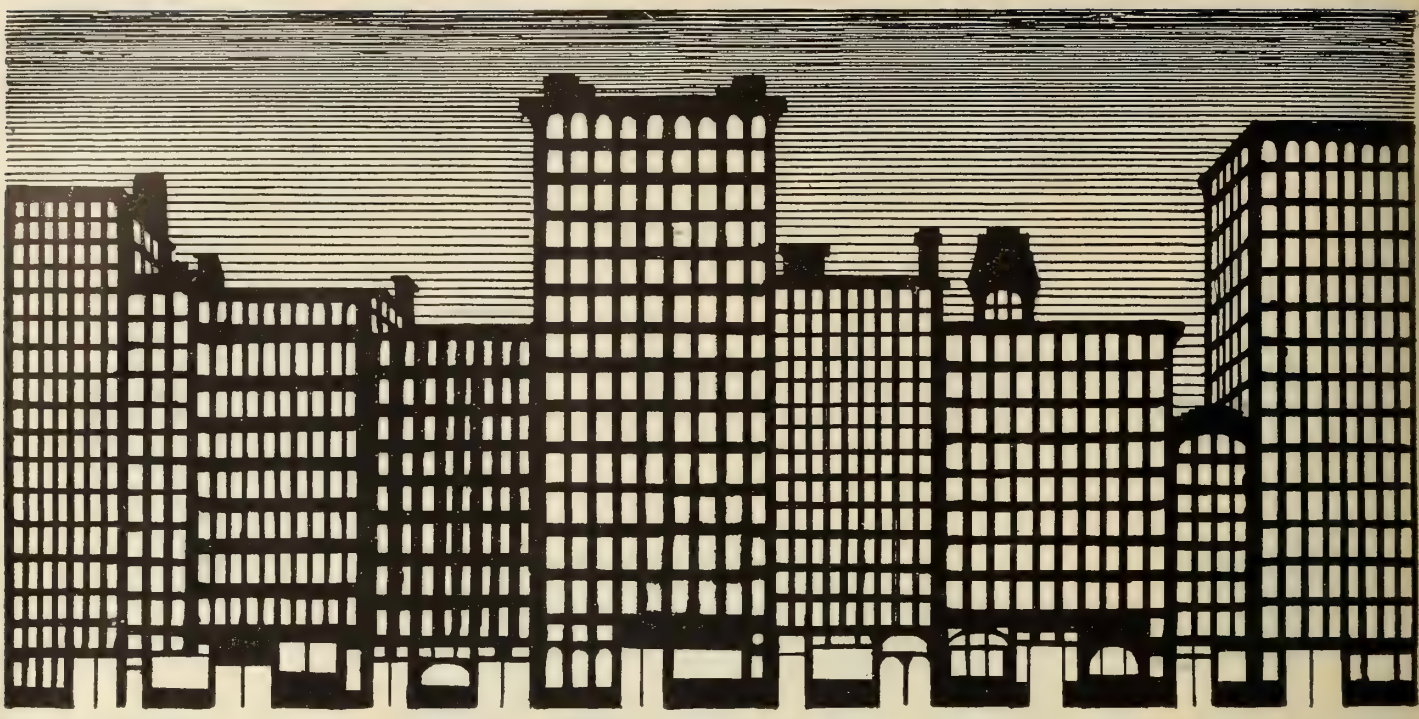
5310 St. Clair Ave., Cleveland, Ohio

Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

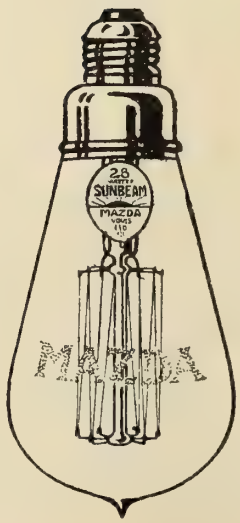
File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario



The Question of Brilliant Better and More Light narrows down to this

Sunbeam Lamps

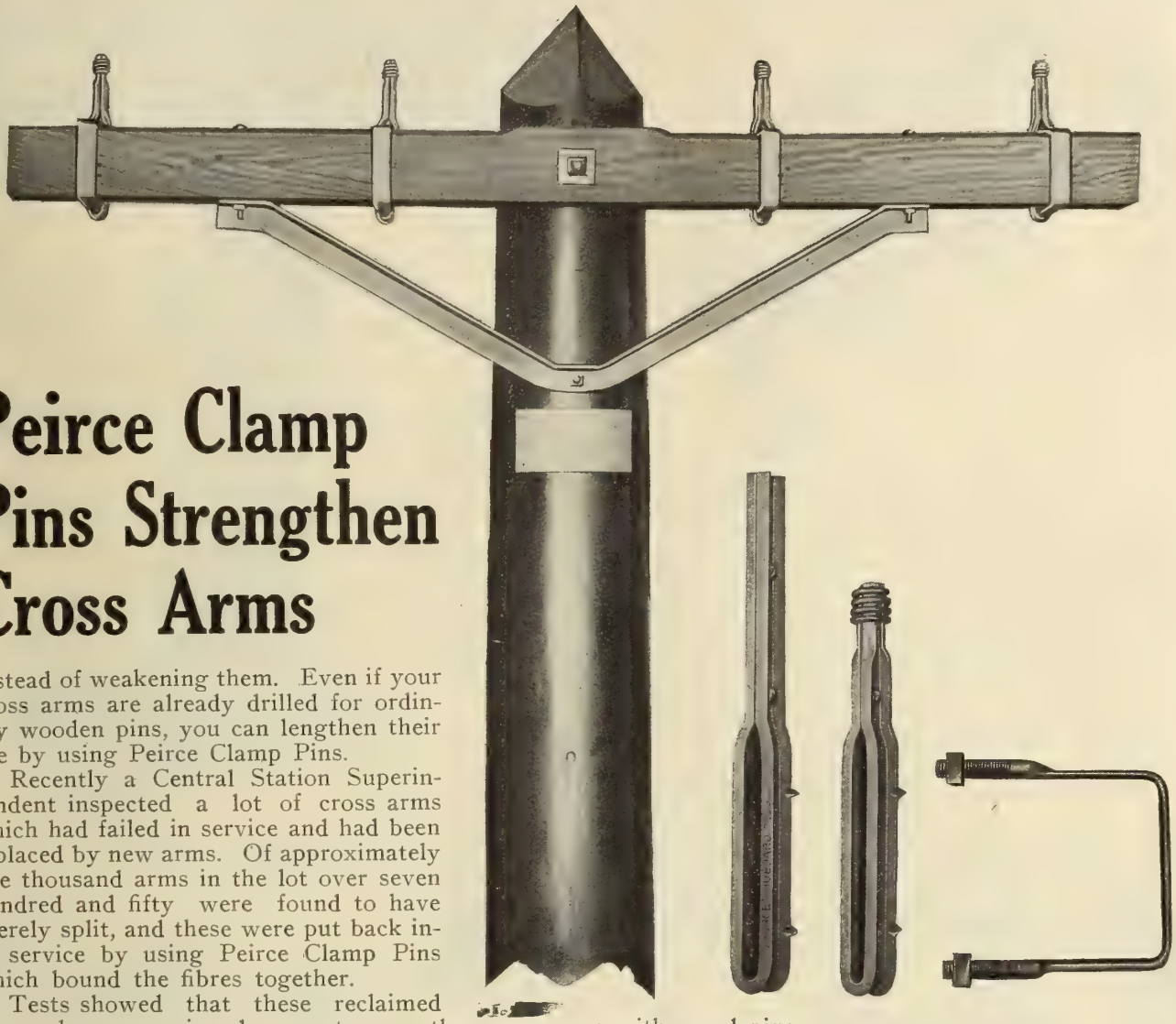


Sunbeam Lamps

Canadian Sunbeam Lamp Company Limited
TORONTO

Branch Warehouse:

MONTREAL **WINNIPEG**
CALGARY **VANCOUVER**



Peirce Clamp Pins Strengthen Cross Arms

instead of weakening them. Even if your cross arms are already drilled for ordinary wooden pins, you can lengthen their life by using Peirce Clamp Pins.

Recently a Central Station Superintendent inspected a lot of cross arms which had failed in service and had been replaced by new arms. Of approximately one thousand arms in the lot over seven hundred and fifty were found to have merely split, and these were put back into service by using Peirce Clamp Pins which bound the fibres together.

Tests showed that these reclaimed arms when so equipped were stronger than new arms with wood pins.

The pins are rolled out of open hearth steel, properly designed for the exacting demands of modern service. The heavy coat of hot galvanizing gives full protection against rust.

Isn't it perfectly evident that, whereas a cross arm is seriously weakened by drilling holes for ordinary pins, it is bound to be stronger when clamped with steel bands such as those used in installing Peirce Clamp Pins?

Remember that a locust pin loses 40 per cent of its strength the first year, while the Peirce Clamp Pin lasts forever, and will carry an 800 lb. strain without deflection. All Peirce Clamp Pins are equipped with



The Peirce Spring Thread

which allows for expansion, contraction or inequality of bore, yet holds the insulator securely at all times.

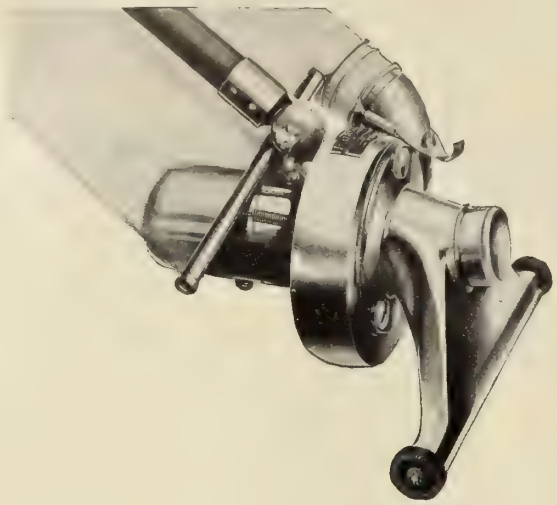
In hot weather, it elongates and creeps further up in the insulator thread, preventing destructive pressure on the glass—in cold weather it still keeps closely in contact, and the insulator can't wobble.

Its resiliency is another advantage, helping to absorb sudden jerks or strains to which the wires might be subjected.

Peirce Specialties and Hubbard Line Hardware are carried by Canadian Electrical Jobbers.

The Hardware MAKES the Line, Hubbard Makes THE Hardware

Hubbard and Company, Pittsburgh, U.S.A.



The EUREKA Electric Vacuum Cleaner

Is Guaranteed to Stand Hard Usage and Give Long Service.

It is used for cleaning any piece of household goods.

It eliminates all of the old fashioned cleaning methods.



A Profitable Specialty

Central Stations and Electrical Dealers have found the Eureka a profitable proposition because every one sold makes the next sale come quicker. The excellent work which the Eureka accomplishes, together with its lasting qualities, keep the owner constantly enthusiastic about it.

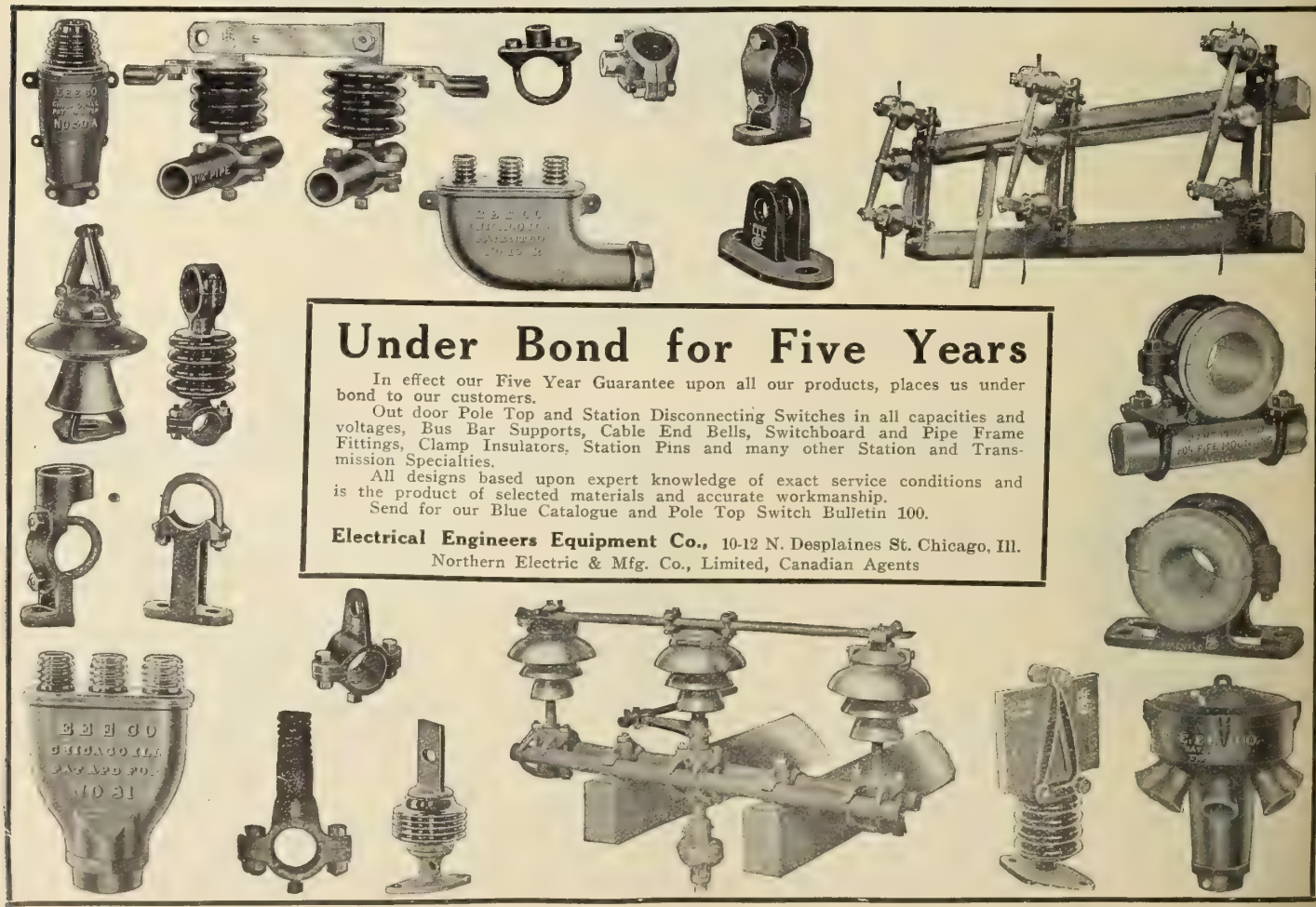
There is no quicker way to convince your patrons of the high merit of electrical appliances than to sell them Eureka Cleaners.

Every Eureka sold helps to sell another.

Write immediately for quotations and full descriptions.

Onward Manufacturing Company

Berlin - Ontario



Under Bond for Five Years

In effect our Five Year Guarantee upon all our products, places us under bond to our customers.

Out door Pole Top and Station Disconnecting Switches in all capacities and voltages, Bus Bar Supports, Cable End Bells, Switchboard and Pipe Frame Fittings, Clamp Insulators, Station Pins and many other Station and Transmission Specialties.

All designs based upon expert knowledge of exact service conditions and is the product of selected materials and accurate workmanship.

Send for our Blue Catalogue and Pole Top Switch Bulletin 100.

Electrical Engineers Equipment Co., 10-12 N. Desplaines St. Chicago, Ill.

Northern Electric & Mfg. Co., Limited, Canadian Agents

Electrical News
Generation, Transmission and Application of Electricity

Published Semi-Monthly By

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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

SUBSCRIBERS

The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Vol. 22 Toronto, December 1, 1913 No. 23

Central Station Co-operation

Much has been written about the central station manager being under an obligation to push, actively, the sale of electric vehicles, and it has come to be taken for granted that he reaps a very large harvest from electric vehicle customers, and therefore is justified in making almost unlimited expenditures in effecting sales. There is decidedly another side to the question, however, and this has been taken up very capably by Mr. E. L. Callahan representing the central stations in a paper printed elsewhere in this issue. The point is brought out, and it is a good one, that the so-called harvest of the central station consists in selling the electric vehicle owner current, at an exceedingly low rate, to an amount which represents less than 10 per cent. of the total cost of operation of the vehicle, and the question is naturally raised why other lines of trade reaping larger benefits should not be counted equally responsible in pushing the sale of electrics. It is pointed out too that profits are often much larger from the "insignificant" little things such as flat irons. It is timely that some one has come to the defence of the central station. The manufacturer, and the public too, may have been expecting too much of the seller of electric current and it is very possible that many a prospective customer may have held aloof at what he considered a lack of confidence on the part of the central station owner in electric vehicles. Looked at from this other side, it would, however, be about as reasonable to expect the manufacturer of rubber tires, or electric lamps or of some other accessory to be actively engaged in selling electric vehicles. If the public can only be brought to see that the central station has comparatively little to gain they will naturally cease to mistrust. The co-operation of the central station is, of course, always a factor to be reckoned with, but the manufacturer himself seems the logical salesman.

We are inclined to think the greatest assistance the central station could give the manufacturer would be his "moral" support in the purchase of one of the vehicles for his own use. It would be of real assistance if the manufacturer could point in every case to the central station as one of his customers. On his part, the central station owner is often in a better position to use an electric than any other man in his city, first, because he has in his employ men who understand the care and use of electrical equipment and, second, because the charging can be so arranged that it costs him little or nothing. Co-operation to this extent may naturally be looked for by manufacturers, not only of electric vehicles but of other electrical equipments and appliances. However if the electric iron yields a larger profit than the electric vehicle the central station owner is only human in being more interested in the electric iron.

The Society for Electrical Development

It will be of interest to manufacturers, as well as to the other branches of the electrical business, to know that forty-one manufacturers have taken out membership in the Society, aggregating over $80,000 annually as their subscription to this very important trade movement. The particular group of forty-one referred to are members of the Electrical Manufacturers Club, at whose meeting last week in Hot Springs the Society was a live topic of discussion both in the meeting and the lobbies.

The affiliation with the society of the other members of the Club is being carefully considered, and their co-operation will undoubtedly raise the subscriptions from this particular group to over $100,000 annually.

The President of the Club, Mr. S. O. Richardson, Jr., in introducing the subject, gave the movement his warm personal endorsement, backed by the statement that his interests, the Libbey Glass Company, joined some months ago. Mr. J. Robert Crouse, in a brief address, emphasized the basic principles involved with special reference to the manufacturers. Mr. Gerard Swope, vice-president of the Western Electric Company, followed, explaining the detail plan of organization and the balanced representation of the grand division of the business. He expressed the opinion that the plan and personnel of the officers and directors gave every promise of efficient and economical expenditure in the work.

Mr. F. S. Terry, manager of the National Lamp Works, addressed the meeting with reference to results which the society can accomplish. He explained that the result of the earlier efforts in this same work in 1906 and 1907 had greatly exceeded expectations, and indicated an efficiency in market development by these methods which can not be attained in any other way.

During the meeting, President Richardson received over fifty telegrams from electrical supply jobbers in all parts of the country, stating they were members, expressing their conviction of its value and the hope that all the manufacturers would join in the movement.

There are, of course, many manufacturers not members of the Electrical Manufacturers Club, so that the figures given in the beginning of this paper are less than the actual facts. The society's objects, plans and methods of membership need only to be really understood to make a successful appeal to those who have not yet joined as it has done to the 700 and more companies in membership. It is in effect a wonderful opportunity for the electrical business to blaze a new trail in creative market development that will be in keeping with the great achievements in electrical research, engineering and manufacture.

A pamphlet covering concisely the principles, plans and

method of membership will be gladly sent, on request to the Society for Electrical Development, Engineering Societies Building, New York.

Hydro Plant for Charlton

The Charlton-Englehart Light, Heat and Power Company are constructing a hydro-electric plant at Long Lake on the White or Blanche River. The natural conditions at this point are such that the power can be developed at a very reasonable cost. Long Lake itself constitutes a splendid storage basin and the rapids to be utilized are situated right at the head of the White River where it leaves Long Lake. For this reason only a very low dam will be required, with a minimum excavation as the river is shallow and down to solid rock. This also is the site of the town of Charlton through which a railway line passes, and the equipment will therefore be delivered practically on the site of the development, thus removing one of the large sources of expense in the average northern plant where the power site is often practically inaccessible.

The hydraulic equipment is being supplied by the William Hamilton Company, Limited, of Peterborough. There will be two vertical turbine units each consisting of a 35-inch Samson water wheel enclosed in a steel plate case with butterfly valves six feet in diameter, and Lombard governors for each unit. Each water wheel unit will have a capacity of 540 h.p. a working head of 37 feet, running 300 r.p.m. The same company have supplied a ten-ton, hand-operated traveling crane as well as the foundation beams for the water wheels, the trash racks and supports.

The head race, which is constructed of concrete, is approximately 125 feet long. Below this there will be 233 feet of 7-foot diameter steel pipe dividing into two branches each 40 feet long and 6 feet in diameter. The pipe line is also being supplied and erected in place by the William Hamilton Company.

The power house, which also includes the transformer house, is 28 ft. x 80 ft., and will be of concrete and steel construction. As regards the transmission line, there is already built and in operation from Charlton to Englehart a transmission line some seven miles long which will carry a current at 11,000 volts. There is also constructed in Englehart a sub-station for the transformation of this current for local use. At the present time there is a small water wheel generator equipment operating in a sawmill on the same falls which is supplying light to Charlton and Englehart. Negotiations are being carried on with consumers in the Swastika district, and if it is decided to supply power to this point, it is understood transmission will be at 33,000 volts.

The electrical equipment is being supplied by the Burnham Engineering Company who will also superintend its installation. This equipment will consist of two 400 kv.a., 60-cycle, 3-phase, 2300 volts, 300 r.p.m. vertical water wheel generators and two vertical belt driven exciters. The Burnham Engineering Company will also supply the generator, switchboard and the switching equipment at the power plant and in the two sub-stations.

Sutcliffe & Neelands are consulting engineers in connection with the installation. Mr. K. Farah is superintendent of the Charlton-Englehart Light, Heat & Power Company.

Souris Lighting Plant

The town of Souris, Manitoba, has awarded a contract to the Accumulator Lighting Company of Winnipeg for the supply and installation of a complete lighting plant to be owned and operated by the municipality.

It is the intention to supply only direct current and for this purpose there is being installed a battery consisting of 120 cells of approximately 1200 ampere hours capacity. These cells have a voltage of 2.70 and are contained in lead lined boxes and arranged to conform to a three-wire 220-110 volt distribution system. The charging end of the equipment consists of two generators one of which will be a spare. The capacities of these generators are 50 kw. and 30 kw. respectively. They are to be belt connected and driven by either of two gas-producer engines of 86 h.p. each, which are at present in use in connection with the water system. The general system of distribution will be, as stated above, a three-wire 220-110 volt system, while the automatic control of street lighting will be taken care of by stringing a fourth wire and connecting it through a time switch to one of the outside wires at the station. The 110 volt street lamps will be connected in parallel across this fourth wire and the neutral of the distribution system thus obtaining independent control of the street lighting at very slight additional cost.

The anticipated average demand on this plant is about 200 amperes consisting almost entirely of lighting. Street lighting will be done by 60 watt tungsten lamps on ornamental iron standards supplied by the Brandon Foundry Company and in addition there will be 130 goose necks, with a single 100 watt tungsten lamp each, for attachment to wooden poles in the outlying sections of the town. Of the ornamental standards there will be 38 two lamp, 7 four lamp, and 17 five lamp units, the latter consisting of four 60 watt lamps surmounted by one 100 watt lamp.

The contract on this plant includes the supply of a balancing set consisting of two 110 volt generators, two charging generators as mentioned above, the storage battery, the necessary switching equipment and board, and erection.

Smithers Light and Power Plant

Arrangements have been completed by Messrs. J. A. Fraser and L. A. Harrison, of Skagway, Alaska, to establish an electric light and power plant in the town of Smithers, a new divisional point on the main line of the Grand Trunk Pacific Railway in Northern British Columbia. The project provides for the immediate installation of a steam plant which will take care of the lighting and power requirements in the district during the coming winter, the equipment consisting of a steam engine to drive a 2300 volt, 2-phase generator carrying 4,000 lamps at a peak load and supplying at least 150 kilowatts for power purposes during the day time. On account of the lateness of the season, it was not considered practicable to proceed with the installation of a water power station this year, although plans have been perfected for a development of this nature on the Bulkley River, a short distance from the town.

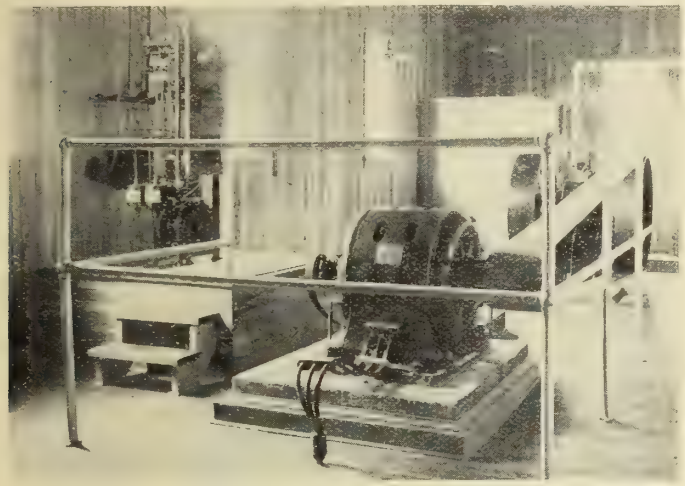
A tentative list of the charges to be made for power and light in Smithers provided for a minimum, including meter rent, of $2 per month, with a discount of 15 per cent. if paid on or before the 15th of each month. The following sliding scale of monthly charges is expected to be put into effect: Up to 49 kw.h., 18 cents; 50 to 124 kw.h., 17½ cents; 125 to 249 kw.h., 17 cents; 250 to 499 kw.h., 16½ cents; 450 to 749 kw.h., 16 cents; 750 to 999 kw.h., 15½ cents; above 1,000 kw.h., 15 cents.

The price of current supplied for electric motors of five horse-power and over will be at a flat rate of $5 per rated horse-power per month.

All other current supplied for power purposes is at the rate of 10 cents per kilowatt hour. The voltage for lighting circuits will be 110 volts, alternating current, single phase. The voltage for power up to, but not over five horse-power, will be the same as for the lighting service. For motors over 5 horse-power, the voltage will be 220 volts, alternating current, 2-phase. It is the intention to reduce these rates when the power plant is completed.

A Pioneer Electric Plant

The lighting plant operated by the Northern Telephone & Power Company in South Fort George, B.C., provides the first distribution system in that district and is a pioneer plant in every sense of the term. Erected under peculiarly adverse conditions in a practically undeveloped section of the province, this plant is a noteworthy example of the enterprising spirit which enters so largely into the daily lives of those associated with the upbuilding of new communities in British Columbia. The equipment consists of one 62½ kv.a., three-



Plant carried 310 miles by horse pack trains.

phase, 2300 volt, 60 cycle generator, belted to a 12-in. x 12-in. centre crank Ideal engine supplied by Messrs. Robert Hamilton & Company, Vancouver agents for Messrs. Goldie & McCulloch, of Galt, Ont. There are two 40 h.p. portable fire box boilers, burning wood fuel which can be obtained in practically inexhaustible quantities in the surrounding district.

All of the electrical apparatus was supplied by the Canadian General Electric Company, and was first shipped from Vancouver to Ashcroft, the nearest point on the main line of the C. P. R. to South Fort George. At Ashcroft the equipment was transferred to horse pack trains and conveyed in this primitive fashion for a distance of 310 miles over rough mountain trails through a country of the wildest description, to its destination.

Their Second Anniversary

On October 13th last the Light and Power Department of the City of Winnipeg celebrated the second anniversary of their birthday and in this connection it is interesting to note the following figures given out by sales manager R. A. Sara which strikingly illustrate their success during these two years of operation. On October 15th, 1911, they connected up their first customer. On October 15th, 1912, they were serving 14,598 customers which figure had increased to 25,615 by October 15th, 1913. Up to October 15th, 1912, the gross output was 19,802,700 kilowatt hours and the gross billings were $243,706.56. During their second year of operation between October 15th, 1912, and October 15th, 1913, the gross output amounted to 43,624,500 kilowatt hours and the gross billings had increased to $767,648.87, that is an increase of over 100 per cent. per year in output and over 200 per cent. per year in gross billings. The gross billings for the month of September, 1913, were $69,619.83 and it is fully expected that they will amount to well over $75,000 per month during the winter months. The peak load for October, 1913, was 12,950 kilowatts and during the month of October, 1912, it was 8,800 kilowatts.

City of Calgary Power Plant Equipment

The following summary of the power situation in Calgary is indicative of steady and sound development and certainly does not show any sign of the general "depression" about which we hear so much. There is probably no more important element in the maintenance of steady business growth than an abundant supply of electric power at reasonable rates. This is evident at the present time not only in Calgary, but in the rapid return to normal conditions being shown by many other of our towns and cities.

Purchased

3800 kw. is purchased from the Calgary Power Company at a rate of $26 per h.p. per annum on a half hour monthly peak basis.

The steam equipment of the City of Calgary's plant is as follows:—

A.c. equipment—in operation.
- 1—2800 kv.a. turbo-generator, Allis-Chalmers.
- 1—3125 kv.a. turbo-generator, Belliss-Vickers.

Now being erected.
- 1—6250 kv.a. turbo-generator, Allis-Chalmers.

D.c. equipment—for street railway operation.
- 1—600 kw. steam driven generator.
- 1—500 kw. steam driven generator.
- 2—1000 kw. motor generators.
- 1—500 kw. motor generator.
- 1—300 kw. motor generator.

Boilers—in operation.
- 12 Babcock & Wilcox 3580 sq. ft. heating surface.
- 4 Babcock & Wilcox 2823 sq. ft. heating surface.

Now being erected.
- 4 Babcock & Wilcox 6000 sq. ft. heating surface.

Street lighting equipment.
- 4—75-light Westinghouse mercury arc rectifier sets.
- 8—75-light C. G. E. mercury arc rectifier sets.
- 2—100-light a.c. constant current arc light equipments.
- 6—35-light a.c. constant current arc light equipments.
- 700 magnetite arcs.
- 300 enclosed carbon arcs.
- 300 250-watt tungstens.
- 100 600-watt tungstens.

Power,—demands at the present time are as follows:
- Street lighting load, 1000 kw.
- Commercial motor load, 2000 kw.
- Street railway load, 2600 kw.
- Lighting load, 3700 kw.
- Normal day load, 5300 kw.
- Combined evening peak, 7000 kw.

Edmonton Activities

As indicating the growth of Edmonton and the corresponding growth in the demand for electric power the following comparative figures of the output of the municipal plant for the months of September and October are interesting:—

	September	October
	kw.h.	kw.h.
Power to electric light dept. ..	993,400	1,177,300
Power to street railway	604,400	647,657
	(Imp. gals.)	
Water to Water Works Dept...	136,849,000	143,142,815

The electric railway operations are gradually improving in Edmonton. During October of the present year the expenditure was $64,800 against a revenue of $52,000 as compared with a year ago when the expenditure was $60,000, against a $43,000 revenue. During the year the city has laid 23 miles of permanent track. Also the rate for current has been reduced from 2.4c to 2c, and it is hoped that in the very near future the system will begin to show a profit.

The city council has reduced the cost of power to all off-

peak power customers to a flat rate of 2c per kw.h. This is taken to include the street railway and the water-works departments. The rate for lighting to the city will be 3c. The following is a summary of the new schedule which was drawn up by Messrs. Ormsby, Woodroofe & Parsons, respectively the superintendents of the electric light, the electric railway, and the power house departments:—

(1) Rates to electric light department: 3c per kw.h. on all lighting feeders; 2c per kw.h. on all off-peak power feeders, it being understood that these feeders are used for power only, and that although in general a 24-hour service will be maintained on them, they are liable to be switched off when necessary at the time of peak load on the power house.

(2) Rates to street railway 2c per kw.h., current to be metered as at present.

A large new territory in the suburban districts has been covered with lights and was illuminated for the first time during the second week in November.

The telephone department has received a shipment of automatic telephone equipment sufficient to install 1,000 new instruments.

Electrification of Railways

Mr. G. Percy Cole, M.Sc., Mem.A.I.E.E., Assoc.M.I.E.E., of the Canadian General Electric Company, addressed the members of the Canadian Railway Club on "The Conservation of Natural Resources through the Electrification of Railways." He spoke of the enormous cost of running locomotives by coal, and estimated that the annual consumption of coal by locomotives in Canada and the United States is approximately 110,000,000 tons. If it were possible, he said, to save two thirds of this, valued at $2 per ton, a yearly saving of roughly $147,000,000 would be effected, which would go a long way towards paying for electrification of our railways. In the process of turning the coal into power we are throwing away 90 per cent. of its value—a serious national concern. When it is considered that 70 per cent. of the average railroads revenue from operation is obtained from the transportation of freight, it is easy to see why railway managers are beginning to study the question of electrification from the standpoint of economy.

Dr. L. A. Herdt and Professor McKay, McGill University; L. C. Ord, of the Canadian Pacific Railway; W. H. Winterrod, electrical engineer, C. P. R.; and R. H. Wheeler, electrical engineer of the Canadian Northern, took part in the discussion which followed the address.

A 10,000 h.p. Motor Installation

Among the many new mills in course of construction along the route of the new Welland Ship Canal, the largest and at the same time most interesting from an electrical point of view is that of the Ontario Paper Company, at Thorold, known locally as the million-dollar paper mill.

The mill is situated about a mile and a-half from the town of Thorold and is supplied with electrical power by the Ontario Power Company, Niagara, Ont. Power is transmitted to the mill at a pressure of 12,000 volts over two 3-phase aluminium transmission lines together with two auxiliary copper lines. These lines enter the mnll through a switch house containing line disconnecting switches, electrolytic lightning arresters, etc., and also two 150 kw. transformers for fire-pump service.

The current is taken from the switch house to the motor room in three core cables laid in steel conduits, one of which cables is used in case of emergency only. These are connected to the high tension bus bars through two three-pole motor operated Canadian General Electric oil switches. The bus chamber is situated on the ground floor over which is mounted the switchboard and all oil switches. The bus structure is of brick and concrete construction.

The most important and interesting feature of the whole plant is the motor room. This room contains five 2,000 h.p., 12,000 volt, 25-cycle, induction motors running at a speed of 246 r.p.m. direct connected by flexible couplings to five lines of pulp grinders; these motors were built by the Swedish General Electric Company, and supplied by Messrs. Kilmer, Pullen & Burnham, Limited, Toronto, and withstood a puncture test of 2½ times the line voltage. They represent, we believe, the largest motor installation in Canada.

The motor starting panels and starting rheostats are placed opposite each motor on the ground floor. The primary switches, which are magnetically controlled, are situated on the switchboard gallery. In connection with the closing solenoid, of the primary motor switches, there is a small switch on the motor shaft, which makes it impossible to close the main switch should the collector rings be left short circuited through neglect on the operator's part.

The small motors in the mill are all operated at a potential of 600 volts obtained from three 600 kw., 3-phase, oil and water-cooled step down transformers built by the Crocker-Wheeler Company. The feeders are taken underground in steel conduit from the motor room and thence in cleat construction to the various points of the mill.

The pulp is pumped from the grinder room either to a storage tank or to the screens by three centrifugal pumps direct connected to three squirrel cage motors, the storage tank being used during the night when all five lines of grinders are run, thus keeping the day load curve as low as possible.

The sulphite beater and also the broke beater are each operated by a 75 h.p. induction motor connected to the beaters with Renolds silent chains.

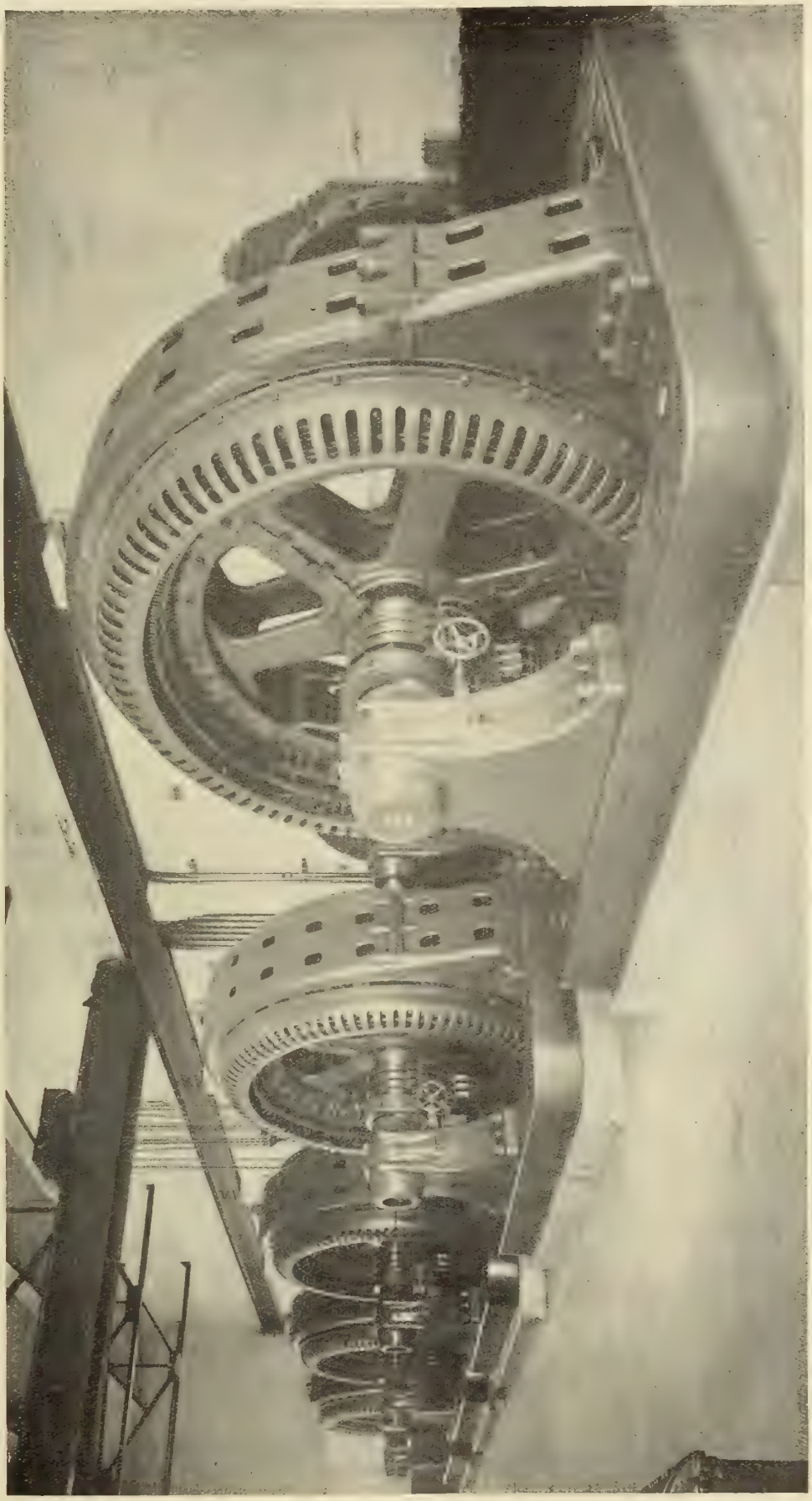
The Jordan machines, of which there are two, are each direct connected to a 150 h.p. auto-synchronous Swedish General Electric Company's motor. All the stock passes through these two machines before passing onto the paper machines.

In the machine room there are two paper machines which are the largest in the world, built by Messrs. Pusey, Jones Company, and are each capable of turning out a sheet of paper 204 in. wide at the rate of 600 ft. per min., or approximately 60 tons each per 24 hours; these machines are driven by two Terry steam turbines running at 150 r.p.m.

The shake on the wet end of the paper machine is driven by motors and so also is the winding gear on the finishing end of the machine.

An interesting feature of the mill is the manner in which the load curve is regulated. This is done by means of a contact making ammeter connected to the main current transformers, which operates an auxiliary relay which in its turn operates a small motor connected to a pressure regulating valve on the water main connected to the hydraulic rams on the pulp grinders. The contact making ammeter is adjusted to the required load according to the number of grinders running. Should this load be exceeded the pressure on the grinder rams is automatically reduced thus cutting down the load on the grinder motors. By this method a remarkably straight load curve is obtained and at the same time all possibilities of running up a heavy peak load are eliminated which is an extremely important item when power is paid for on a peak load basis.

It may be interesting to mention here that a cargo of sulphite was recently shipped direct from Norway to Thorold in the S.S. Glenfoyle thus making Thorold a port for ocean going boats for the first time, which goes to show how electrical developments open up a country, as no doubt the primary reason for the Ontario Paper Mill being where it is, is cheap power.



The largest motor installation in Canada—Five 2,000 h.p., 12,000 volt, 25 cycle, 3 phase, 246 r.p.m. Swedish General Electric induction motors just installed by Messrs. Kilmer, Pullan & Burnham in the mills of the Ontario Paper Company, Thorold, Ont.

Heating of Pipe-Ventilated Machines

By Alex. Gray* B. Sc., Wh.Sc.

When an open motor is totally enclosed, its output has to be greatly reduced in order that the temperature inside of the machine may not be excessive; when, however, a machine is pipe-ventilated, that is, totally enclosed and cooled by blowing cold air through the machine, its output can generally be increased over that as an open motor, for the same rise of temperature in each case. Slow-speed, open type motors, in particular, have poor ventilation and are therefore designed with low copper and iron densities; if totally enclosed, and cooled by forced ventilation, higher densities could be used and the size and cost of such machines considerably reduced.

To determine some heating constants for pipe-ventilated machines, tests were made on the machine shown to scale in Fig. 1. The rating of this machine as an open motor was 80 h.p.; when totally enclosed its output was 25 h.p., and when pipe ventilated was 100 h.p. at the same speed and with the same temperature rise in each case. The machine was a standard induction motor with the yoke and housings cast without ventilating openings and no attempt was made to assist cooling by attaching radiating ribs to the frame. The outlet C, Fig. 1, was connected to a suction fan which drew air into the machine at A. In passing from A to C, the air has to pass through the windings and over the back of the stator core or through the rotor spider. The motor was direct-connected to and loaded by a totally enclosed d.c. generator so that there was no fanning effect caused by a belt.

To determine if there is a law of the form:—Temperature rise $= k \frac{\text{watts lost}}{\text{cu. ft. of air per min.}}$

The results obtained from several heat runs are given in Table 1. During these tests, the quantity of air passing

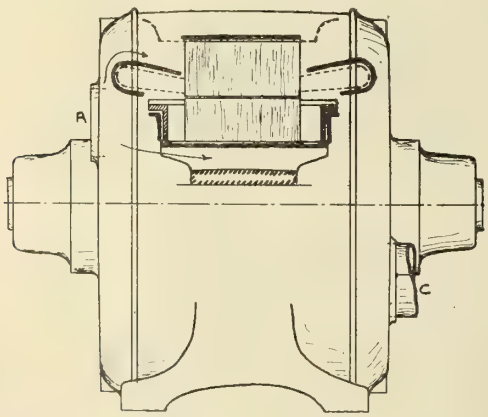


Fig. 1.—Rotor dia., 17 in.; revs. per min., 1180; rotor perip. vel (V), 5200 ft. p. m.; ex. surface of frame, 3750 sq. in.; surface shown heavy, 2.26 sq. ft.; area of air paths, 1.25 sq. ft.; cu. ft. of air per min., Q(see table); air velocity (ft. per min.) Q/1.25.

through the machine was controlled by throttling the fan discharge; the air velocity was measured by an anemometer placed in the inlet passage, the anemometer being large enough to fit snugly into this passage; the temperatures were taken by thermometers and that of the stator winding was also taken by resistance.

In open type motors, the distribution of the total loss between the copper and the iron has a pronounced effect on the rise in temperature,† but an analysis of the results in Table 1 shows that, for a given current of air passing through the machine, the temperature rise is independent of the distribution of the loss and depends only on the total loss.

The test results are plotted in Fig. 2 and replotted in Fig. 3 in more convenient form. The curves in Fig. 3 are straight lines. It was expected that these lines would pass through the origin but it will be seen that, in each case, they pass through a point P such that, for a loss of .9 kw., there

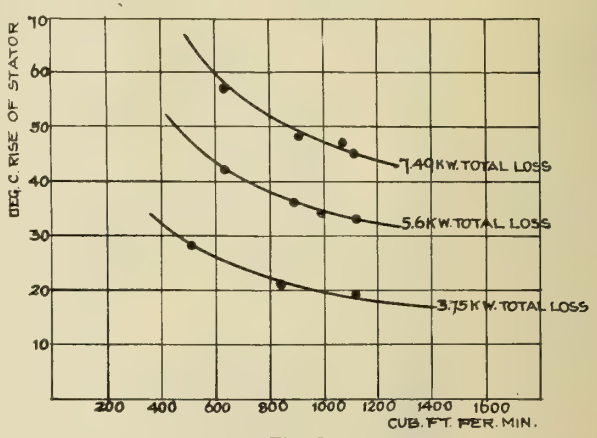


Fig. 2.

is no temperature rise in the windings. The bearing friction loss in the machine was .9 kw. and it would seem that this loss is got rid of by the frame and shaft without having much effect on the internal temperature of the machine.

The curve in Fig. 4 is obtained from the data in Fig. 3; from this curve it may be seen that, even when no air is passing through the machine, a certain amount of heat is dissipated by the frame; in this particular case, 36 watts per 1 deg. C. rise. Previous tests† on totally enclosed machines

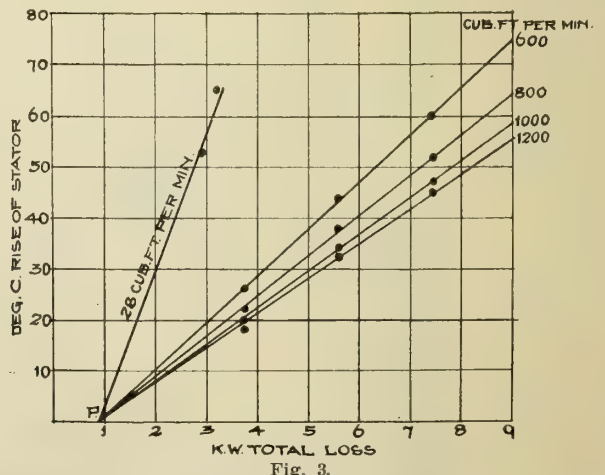


Fig. 3.

showed that the watts dissipated per sq. in. of frame surface for 1 deg. C. rise of the windings $= 0.0044 + 0.0012\ V_1$, where V_1 is the peripheral velocity of the rotating member in 1,000s of ft. per min. The value of V_1 in the experimental machine was 5.2 and the external surface of the frame was 3,750 sq. in. for which values the watts per sq. in. for 1 deg. C. rise $= 40$ by calculation; this compares favorably with the test result of 36.

* Assistant Professor Electrical Engineering McGill University.

† Gray, Induction Motor Heating, Trans. A. I. E. E. June, 1909.

Analysis of Heating by Forced Ventilation

If T_2 is the temperature of the windings in deg. C.

T_1 is the temperature of the air at the outlet in deg. C.

T_0 is the temperature of the air at the inlet in deg. C.

then, since 1 lb. of air has a volume of 14 cu. ft. and a specific heat of .238, an air current of 1 cu. ft. per min. carries with it .536 $(T_1 - T_0)$ watts.

When air is blown across a heated surface with a velocity of V ft. per min., the watts transferred from the surface to the air for a given temperature difference increases with

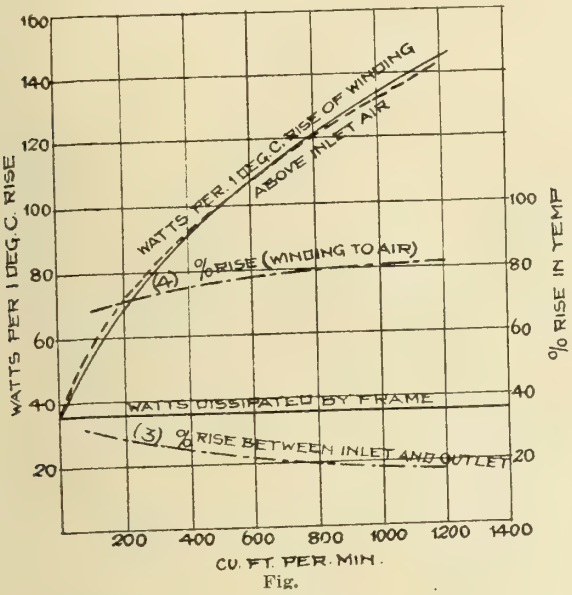


Fig.

the air velocity and with A, the number of square feet of heated surface. In the above tests it was found that

$$T_2 - T_1 = \frac{\text{watts loss}}{1.86 A \sqrt{V}}$$

and since $T_1 - T_0 = \dfrac{\text{watts loss}}{.536\ Q}$

$$\text{therefore } T_2 - T_0 = \text{watts loss} \left\{ \frac{1}{1.86\ A \sqrt{V}} + \frac{1}{.536\ Q} \right\}$$

where watts loss = total loss — bearing friction — watts radiated by the frame.

Q = the current of air in cu. ft. per min.

A = the radiating surface shown by heavy lines in Fig. 1 in sq. ft.

V = the air velocity in ft. per min. and is equal to Q/ (area of path behind core and through spider).

The curve corresponding to the above equation is plotted as a dotted line in Fig. 4 and checks the test curve closely.

Conclusions

1. The apparatus and the time were not available to enable tests to be carried to extreme limits, and the analysis is of the same degree of refinement as the tests, many corrections such as that due to the effect of the air velocity on the watts dissipated by the frame and that due to the temperature gradient across the frame surface being neglected both in the tests and in the analysis. The following conclusions, however, are of interest.

2. The temperature rise of the windings is proportional to the total copper and iron loss in the machine and is independent of the distribution of this loss.

3. The bearing friction loss has little effect on the internal temperature of the machine.

4. If the quantity of air passing through the machine be increased by increasing the area of the air passages, the air velocity being kept constant, the temperature rise will be reduced but, in most cases, an increase in the air velocity will be more effective; this may be seen from curves 3 and 4, Fig. 4. This statement requires further investigation at high velocities because, at such velocities, the air friction loss and the consequent heating of the air may more than compensate for the increased cooling effect due to the higher velocity; the statement is true, however, up to velocities of about 4,000 ft. per min.

5. The rating of a pipe ventilated motor is very much greater than that of a totally enclosed motor of the same size and is sometimes greater than the rating of the same machine as an open motor.

C. N. R. Telegraph Work

The Canadian Northern Railway Company have just completed their telegraph line between Ottawa and Sydenham and now have a continuous metallic system of telegraph connection between Ottawa and Toronto, the wires being one No. 6 and one No. 8 iron. The company have also under construction 550 miles between Sudbury and Port Arthur which will be composed of two No. 6 iron wires. The company are anxious to have this latter line completed by the new year and the contractors are putting forward every effort to meet their wishes. There are four crews of thirty men each working on this line, constructing at the rate of one mile per day per crew. The above construction work is all in charge of Messrs. Dixon and Gelling, contractors, Ottawa. The same firm will also construct a line between Ottawa and Pembroke.

Table 1 —Figures obtained from several heat runs.

Volts	Amp.	Stat Copper Loss K.W.	Rotor Copper Loss K.W.	Core Loss K.W.	Windage and Friction K.W.	Total Loss K.W.	Cu. Ft. of Air Per Min.	Deg. Cent. Rise of Winding
440	96	1.82	1.56	1.3	.90	5.58	1120	33
440	96	1.82	1.56	1.3	.90	5.58	990	34
440	96	1.82	1.56	1.3	.90	5.58	890	36
440	96	1.82	1.56	1.3	.90	5.58	635	42
440	120	2.84	2.45	1.3	.90	7.49	1120	45
440	120	2.84	2.45	1.3	.90	7.49	1070	47
440	120	2.84	2.45	1.3	.90	7.49	910	48
440	120	2.84	2.45	1.3	.90	7.49	630	57
560	48	.45	.20	2.2	.90	3.75	1120	19
560	48	.45	.20	2.2	.90	3.75	840	21
560	48	.45	.20	2.2	.90	3.75	510	28
250	72	1.02	.86	.42	.90	3.2	28	65
440	48	.45	.25	1.3	.90	2.9	28	53

Co-operation in Electric Vehicle Sales

By E. L. Callahan*

From the view point of the electric-vehicle manufacturer, the principal objects to be attained through co-operation are: the greater satisfaction among vehicle users, the reduction of their operating difficulties and the resulting increased sales, also the vehicle sales made possible by the good example established in the use of vehicles by the eleceric-service companies and because the service companies are in a position to advise the manufacturer of live prospects for the purchase of electric vehicles.

From the viewpoint of the electric-service company, the advantages to be realized are:

The promotion of the sale of electricity, thereby increasing revenue.

Improved operating conditions; i.e., through obtaining a considerable "off-peak" charging business the central-station load-factor is improved, and the cost of production reduced.

Advertising; the service company feels that every electrically operated machine, be it an automobile or a buzz-saw, is an advertisement instrumental in bringing new customers to its lines.

Furthering the interests of the industrial and social progress of the communities in which the central-station company operates, for any improvement in civic welfare is ultimately reflected to the service company either in improved surroundings and aesthetic betterment, or in good, round dollars.

These are the chief reasons for co-operation, I believe, and are worthy of consideration.

Fundamentally, there appears to be only one logical point of contact between the electric-service company and the electric-vehicle user, that is, the sale of current for charging. Is it not rather strange that the central-station companies are asked to render assistance in making the sale of a machine in which they are interested in only one item of its operation? The total annual cost of current for operating electric vehicles is seldom as high as 10 per cent. of the total annual cost of owning and operating same. Can the central-station company, therefore, be expected to carry any great amount of the burden when it receives less than 10 per cent. of the money spent by the customer? Do the gasoline manufacturers lend any material assistance in the sale of gasoline cars? The gasoline manufacturers receive a far larger part of their total revenue from automobiles than do the electric-service companies! However, the electric-service companies are vitally interested and will co-operate with the vehicle manufacturers, thereby doing their part in advancing the electric-vehicle business to the mutual advantage of all concerned.

From the customer's viewpoint, the most conspicuous advantage accruing from the use of electric vehicles are: the ease, convenience and graceful luxury of the pleasure vehicle; the low operating expense, increased radius of operation and general fool-proof construction of the truck, and of both the simplicity and freedom from breakdown, the absolute reliability and the avoidance of expensive attendance.

What can the service companies do to emphasize these characteristics or bring them more forcibly to the attention of the public?

First, by setting a good example. I understand that the Commonwealth Edison Company of Chicago has about 100 electric trucks and is greatly pleased, not only with their performance in delivering material and for general transportation purposes, but equally well with the advertising gained by their use.

It often occurs that, in buying automobiles for electric-service company use, the choice of cars is left to the discretion of the purchasing agent, superintendents, or men not directly interested in the development and increased output of the company. Therefore, in selling electrics to central-station companies, the salesman should go to the manager and to the commercial department and to the men who are interested in advancing the welfare of the company and the city—not alone to the prospective operatives of the machine, who, perhaps, are more interested in the joy rides they may be anticipating or the noise they may be able to make with an open exhaust in a gasoline car. From the viewpoint of a driver, an electric may have advantages over gasoline cars or over horse-drawn vehicles, or it may not, but from the viewpoint of the man selling electricity and responsible for the advancement of the use of electricity, there is no alternative but the electric vehicle within its proper sphere of proven usefulness.

Second: there is the consideration of cost of operation. A great deal of comment (to use a mild term) has been made relative to the failure on the part of electric-service companies to lower their rates for current to charge electric vehicles. It has been urged that the excellent character of this load and the assumed inexpensiveness of producing such service have been ignored. There are probably some service companies charging rates out of proportion to the cost of this service; however, these are among a fast-declining minority, and they are gradually coming to a realization of the advantages of proper rates.

Current cost not a large faetor

Let us see what advantages may be derived from lower rates for charging. I find that the cost of practically every other commodity incidental to the vehicle industry is increasing in price—and, as an example of this, I would mention gasoline—while the cost of electricity has been lowered, not slightly, but, in some cases, as much as 50 per cent. In arguing for lower rates, it is cited that the vehicle-charging load is an "off-peak" load, and so makes no demand upon the central-station's capacity. This is largely true and deserves careful consideration, but, on the other hand, the service company's investment is not only in generating equipment, but also in lines and transformers, and the amount of such investment is often about equally divided between the generating plant and distributing system, including transformers, meters, etc. A garage requires just as much capacity in lines and transformers as any other load of similar size, and, in the case of private garages, the line requirements are often very much heavier than for other customers using a like quantity of current, notwithstanding the "off-peak" character of the load. Under such circumstances only a slight reduction in rates, if any, below those charged for other classes of service is justifiable.

A recent study of rates in a city of 325,000 inhabitants resulted in the establishment of a rate for charging of 3.8 cents per kilowatt-hour for the first 1,000 kilowatt-hours, and reduced thereafter for larger consumptions. But after all, what inducement does reduction in rates hold out to vehicle users? From various sources, including the classic work of the Massachusetts Institute of Technology, the Report of the School of Mines of Columbia University, and others, it is found that the cost of current for charging is very seldom as high as 10 per cent. of the total cost of operation,

*Presented before the Electrical Vehicle Association Convention.

including proper interest and depreciation charges, and by proper depreciation charges I do not mean the exorbitant rates that may grow out of the mind of some warped economist, but the rates adopted by the most eminent authorities. The cost of current for charging being, therefore, less than 10 per cent. of the total cost of average trucking work, a 20 per cent. reduction in the price of current would mean less than a 2 per cent. reduction to the vehicle user in the cost of operation—truly an insignificant portion of the total expense.

Should Central Stations be active in selling

It has often been suggested that electric-service companies should take an active part in the sale of electric vehicles, that they be displayed in showrooms, demonstrated by the selling force and advertised as are other current-consuming devices. It has often been suggested that central stations might well abandon the electric flatiron, with its "insignificant consumption" and turn their energy to the sale of electric vehicles, "using many times as much current." In discussion of this suggestion, I would say that the sale of a flatiron increases the company's annual revenue by almost three times the price of the iron, while the electric vehicle increases the annual gross by only about 6 per cent. of the selling price of the vehicle, that is, a flatiron selling for $3 will produce an annual revenue of $8, while an electric truck selling for $3,000 results in an average annual revenue of only about $175. A flatiron produces a revenue equal to its original selling price in about 4½ months, while an average electric truck requires about 17 years and a pleasure vehicle about 25 years.

Another excellent reason for the service company not going into the automobile-selling business is that it is too foreign to the business of the company, requiring a separate organization and, not naturally falling in any wise within the scope of the service company's functions. It may often occur that the central station has a garage for its own machines and may find it expedient to care for a few other vehicles; in that case, if the business is found profitable and works no hardship upon independent garages, it is certainly a commendable plan, but such a garage might equally well have been established and operated by any other interest. Likewise, if the service company finds that it can sell machines as a profitable business and without interfering with its patrons, all well and good, but the central station should not be asked to sell or provide garage facilities for electric vehicles with the expectation of a profitable return from the increased electric revenue.

It has often been urged that service companies might do extensive advertising and sales work in co-operation with the electric vehicle manufacturers. A great many service companies are doing this on a large scale, but let us see how far they should go into this matter. Active central station interested in developing its business, today spends about 2½ per cent. of its gross revenue in soliciting and advertising, or, it is found to be necessary in getting business and in advertising, to spend about 25 cents for each $1 of increased annual revenue. On the same basis, the central station would be warranted in spending about $45 in obtaining an electric-vehicle customer. This includes the advertising and soliciting of unproductive prospects, as well as actual purchasers, and is based upon the revenue from a commercial vehicle. Considering the revenue from a pleasure vehicle, estimated at $80 per year, the permissible expense for advertising and soliciting becomes about $20. It is quite possible that when the desirable nature of this load is fully realized and the advertising incidental to the use of the electric vehicle and the general improvement in commercial and civic conditions is taken into consideration, that central-station companies might be warranted in spending as much as $60 for each commercial truck and $25 for each pleasure vehicle placed.

It should be remembered that part of this expense is necessary after the sale is made in arranging for contracts for service, purchase of charging equipment, etc. This probably seems like a small contribution when compared to the efforts made by the electric-vehicle manufacturers; but there is another side of this question. The actual amount of money which the electric-service company appear to be justified in spending would not be a fair measure of its effort toward the larger sale of electric vehicles, for service companies have complete working organizations in close touch with every industry in their respective cities and are already doing business with practically every industry. The electric-service companies have the confidence of their customers, and their representatives are looked upon and referred to as authorities on related commercial and engineering questions. More, by far, can be accomplished in the advancement of the use of electric vehicles through these representatives than with the same expenditure of energy through any other channel available to the central station.

I will undertake to outline a plan of co-operation in the form of a few well-meant suggestions addressed to the vehicle manufacturers.

First. Do not waste your time in an effort to obtain a reduction in electric rates; the entire elimination of the cost of current for charging would result in a saving of only 10 per cent. of the total expense of operation and ownership.

Second. Do not expect the central station to sell your cars for you, or to spend unreasonable sums of money in advertising electric vehicles. Do not urge the displacement of revenue producers that are, at present, many times more effective, to make room for electric vehicles.

Third. Do not expect the electric-service company to go into the garaging business for the purpose and with the expectation of obtaining the profit of the business from the sale of current.

To urge any of these measures will only waste your time and that of the central-station manager, and delay genuinely productive co-operative efforts.

Suggestions

In the foregoing, I do not want to be over-critical, but there has been so much unfounded criticisms of the central stations because of their "failure to assist the electric-vehicle manufacturers," that I believe my statements have been warranted. I believe that many electric-service companies have been very slow to take up and push the sale of electric vehicles as it should be pushed, and that, thereby, they have failed to grasp an excellent opportunity to co-operate with you to mutual advancement. I now wish to offer a few suggestions, which, I trust, may lead to better co-operation and speedier recognition, on both sides, of the benefits to be derived therefrom.

First, there are about 1,500 copies of the Electrical Salesman's Handbook, published by the Commercial Section of the N. E. L. A. (new sheets for which are issued quarterly) in the hands of as many central-station power and lighting solicitors, each daily calling on the manufacturing companies and other big industries in his city. This loose-leaf book contains accurate data on the consumption of current, and a description of the application of electric power to the various miscellaneaus industries. The book is very instructive, highly esteemed and constantly referred to by both the solicitors and their prospective customers in determining the merits of electric power. Only a limited amount of data on the subject of electric vehicles is contained in the book at present. It should contain a great deal more and of a very comprehensive nature. An immense quantity of such data is available, but has never been offered to the Commercial Section. The Commercial Section recommends, therefore, that the Electric Vehicle Association appoint a committee to collect the most reliable and dependable data available, showing the cost of operating electric vehicles in various

classes of work, the saving and increased efficiency that may be effected, giving briefly the information required by a prospective customer in making an intelligent decision in solving his transportation problems. This data, if properly compiled, will be recommended for publication and distribution by the Commercial Section to its membership.

Second. Under present conditions, I believe you will agree with me that only a very small part of the advance information received by vehicle manufacturers concerning prospective purchasers of vehicles originates from central stations. The exact reverse should be true. I would recommend, therefore, that in approaching central-station companies the manufacturers urge that the central-station representatives—new business men especially—be instructed to report all prospects which come to their attention. These men spend practically all their time among the very people that the manufacturer is trying to reach and should be able to render considerable assistance in giving advice to prospective vehicle purchasers.

Third. A great many electric-service companies credit their commercial men with contracts signed and so rate them for promotion, advances in salary, etc., and, in some cases, give them a monetary commission for such contracts. I do not, however, know of any company crediting its men with the placing of electric vehicles. In central-station work, the greatest credit is given the solicitor or salesman who displaces or prevents the installation of an isolated plant. Then why should not the salesman have credit for placing an electric vehicle, which surely displaces an isolated plant—a gasoline engine of from 20 to 75 horse-power capacity? I earnestly recommend that the central station be shown that just as much credit should be given for the placing of an electric vehicle as for a contract for any other power of similar character. True, the central-station company now gives its salesmen credit when a rectifier or charging equipment is contracted for, but it should be remembered that the revenue is not proportional to the number and capacity of rectifiers or charging equipments installed, but to the number of machines charged, whether they be charged in individual private garages or all at one place. The giving of proper credit to salesmen by central stations for the sale of, or for being instrumental in the sale of, electric vehicles will be equivalent to the addition of several thousand vehicle salesmen to the forces now at work in the field.

Fourth. Wherever such a step is feasible, it should be recommended to central stations in the cities of medium and small size that an inspection department be maintained for the purpose of examining vehicles without cost to consumers and giving owners whatever technical advice they may desire. This cannot be made a general recommendation, because I do not believe that it applies to all central stations or communities, and would be unwarranted and impracticable in large cities.

Fifth. For the purpose of instructing and educating central-station employees in the construction and operation of electric vehicles and in the advantages to be derived from their use, that the manufacturers co-operate with the central stations by offering a brief course of instruction, preferably at the manufacturer's plant. This should compare, on a small scale, with the lecture courses now offered by the large manufacturers of electrical machinery. In many cases, it would be found more expedient to have the manufacturers' representatives co-operate in person with the sales department and central-station employees on the ground and actually in the field of operation.

In concluding, I wish to invite the frankest possible comment and criticism and to ask that any and all suggestions that you may have to make on this very important subject be offered freely and fully. I can assure you, speaking for the Commercial Section of the National Electric Light Association, that the progressive electric service companies are willing and anxious to co-operate with you in every feasible way for the advancement of the electric-vehicle industry and that they will be only too glad to take up and adopt any reasonable suggestions that are offered and to meet you more than half way.

Personals

Mr. P. Whitfield has been appointed electrical superintendent for the town of Battleford, Sask.

Mr. S. L. B. Lines, general manager of the Chamberlain & Hookham Meter Company, is spending a few weeks in Western Canada.

Mr. A. B. Coryell has been appointed general superintendent of the Moncton Tramways, Electricity & Gas Company, succeeding Mr. Price, who has been transferred to the Pittsburgh office of this company.

Mr. R. W. Bruce, of London, Eng., has been appointed general superintendent and chief engineer of the Canada Electric Company, Amherst, N.S., and also will have charge of the electrical equipment of the Maritime Coal, Railway & Power Company at Joggins Mines.

Mr. F. K. Martin, for the past five years electrical superintendent for the town of Battleford, Sask., has accepted the position of electrical superintendent for the town of Humboldt, Sask., his new duties to commence on December 1. Mr. Martin was previously electrical superintendent for the Canadian Ship Building Company.

Mr. R. Sidney Imray, outside engineer of the Siemens Company of Canada Limited, has just left Nova Scotia, where he has been putting up the various electric hoisting engines and turbo-generators supplied by his company to the coal companies in that district. He is now proceeding to British Columbia to take charge of the erection of large electric hoisting engines for the Canadian Collieries.



Mr. W. M. Arnold.

Mr. W. M. Arnold, who for the past 18 months has been purchasing agent for the Ottawa Car Company has been appointed assistant manager, succeeding Mr. W. K. Jeffrey, who was made general manager some months ago. Mr. Arnold in addition to his new duties will, however, still act as purchasing agent for the company. Another promotion, or rather addition, to the staff is that of Mr. H. T. Burpee, who has been bookkeeper for the past eighteen months for Ahearn and Soper, Limited. Mr. Burpee has been appointed controller of the office and accounting staff for the Ottawa Car Company.

Obituary

Mr. Andrew Sangster for many years superintendent of the municipal electric light department of the city of Sherbrooke, Que., died suddenly at his home on November 9th.

Mr. Russel D. Willson, assistant city engineer of Winnipeg, Man., met his death by accidental electrocution, in the well house at City Well No. 18 about ten miles north of the city of Winnipeg, on November 17th. Mr. Willson was a graduate of the Faculty of Applied Science and Engineering of the University of Toronto, in the year 1901.

Testing of Telephone and Telegraph Lines

By Mr. T. H. Nicholson

The Voltmeter Shunt Coil (Con.)

This table may be extended to include the resistances indicated with a 100 volt shunt as well as the 1000 shunt and may also show the probable distance to the trouble under various conditions. By these means a good deal of valuable time can be saved, and more uniform results obtained.

The High Resistance Voltmeter

The 30 volt scale instrument is generally the best for local testing, but on toll work, and occasionally on local work, a higher voltage is necessary. It is true that a 30 volt instrument can be obtained with a higher internal resistance, and this makes possible the measurements of higher resistances than can be done with the usual meter, which has a resistance of from 1000 ohms to 5000 ohms, depending on make and scale arrangement.

This high voltage is rarely required, however, in local testing, and as the low resistance instrument is more adapted to general needs than the higher, it is often found desirable to combine the two. This can be done by obtaining an instrument with double scales, one for 30 volts and another for 100 volts. If a low resistance voltmeter is already in use it can readily be converted to the double scale type by adding resistance to its circuit. The method of doing this is shown in Fig. 14 which illustrates a 30 volt instrument having a resistance of 1500 ohms. A key is arranged to insert an additional battery of 70 volts, and an additional high resistance, directly in series with the voltmeter, regular battery and test circuits. The added resistance must of course bear the same ratio to the added volts as the original resistance does to the original volts, so that the added resistance is

$$\frac{70}{30} \times 1500 = 3500$$

The method of determining the external resistances indicated is just the same as for the regular meter and as given above, and applying this, the resistance "A" is found to be 25,000 ohms when the voltmeter shows a deflection of 5.

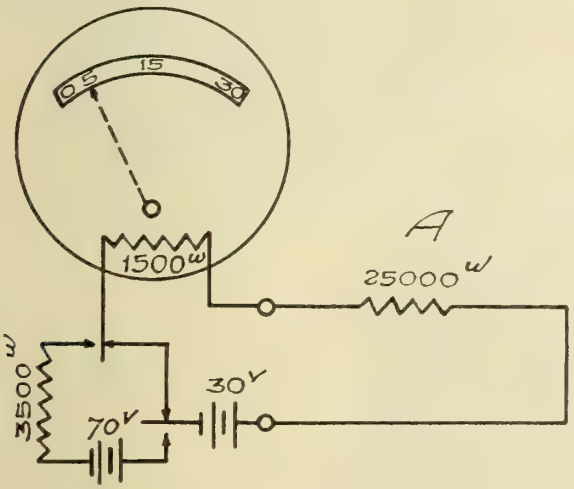


Fig. 14

By the use of this arrangement a definite standard of line insulation can be set and maintained without the necessity of elaborate bridge measurements.

Choice of Voltmeter for Testing

It is necessary to exercise a little care in the selection of voltmeters for testing purposes. Inasmuch as an instrument used under these conditions has its moving element very frequently operated, its bearings or pivots should be of the best quality, and so arranged that a permanent adjustment is assured. In addition to this it should be as nearly dead-beat as possible—that is, the needle should come to a dead stop when the point of maximum deflection is reached. This is in order that the operator does not have to wait for it to come to rest after each change in the circuit, as is the case with some instruments. Then again for ballistic tests the instrument must be absolutely dead-beat, not nearly so, otherwise it is impossible to determine the capacity of a line, or the number of condensers across it.

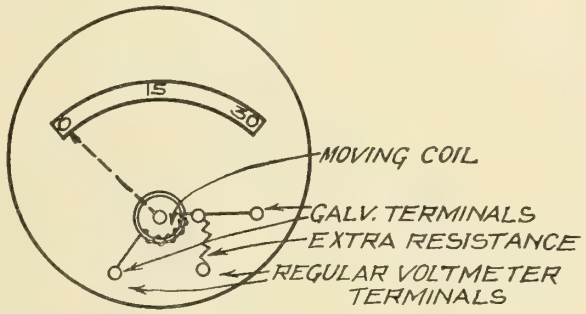


Fig. 15

The resistance of a voltmeter is not, as is often supposed, contained entirely in the moving element, in fact very little of the resistance is represented in the actual instrument. This fact makes possible the arrangement shown in Fig. 14 where by adding resistance in series with the circuit, a higher scale instrument is obtained. The armature of the voltmeter has a small winding usually less than 100 ohms, and the rest of the resistance is simply a resistance coil mounted inside the case.

When it is desired to use the voltmeter as a galvanometer, as later described, it is necessary to cut out this extra resistance, and use only the armature, or moving element of the instrument, for this purpose. Therefore it is advisable to obtain instruments with which this can readily be done. Fig. 15 shows how this is usually accomplished, and also how the average voltmeter is arranged.

Mr. J. E. Brown, superintendent of the Ottawa Municipal Electric Commission, recently reported to Mayor Ellis that some of the underground electric cables owned by the commission are being affected by electrolysis caused by current from the rails of the street railway. Representatives of the Ottawa Electric Company, the Ottawa Electric Railway Company, and the Bell Telephone Company took the matter up with Mr. Brown and after some discussion it was decided to allow officials of the Ottawa Electric Railway Company to make a survey of the whole street railway system in the city and report the results at another meeting to be held in a month's time.

Mr. Brown submitted a piece of cable taken from a manhole in the centre of the city, on which the sheath had been affected by electrolytic action. The damage was done where the cable lay on the iron hook at the side of the manhole. Mr. A. A. Dion, general manager of the Ottawa Electric Company, stated that he had made a general survey of the city, but he had not found conditions as Mr. Brown had reported.

Plans are reported as in progress on a telephone exchange to be built by the Bell Telephone Company on Eccles Street, Ottawa, at a cost of $25,000.

Electric Railways

Mount Royal Equipments

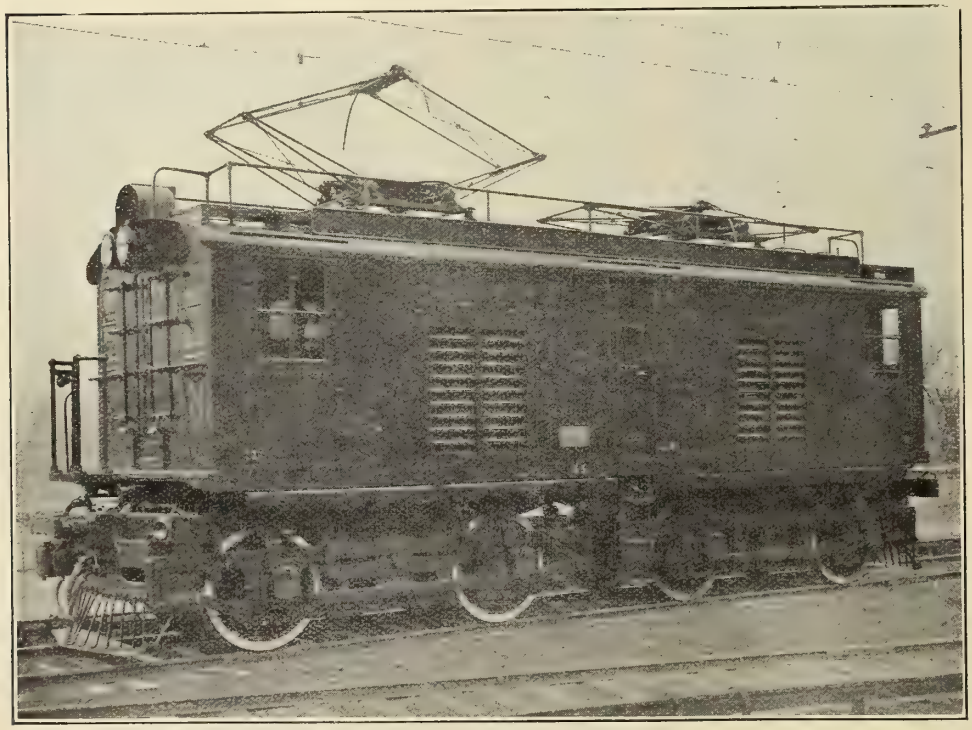
The tunnelling of Mount Royal by the Canadian Northern Railway Company, in order to reach a terminal in the centre of the City of Montreal, was a daring conception, and it was rendered practicable only by recent improvements in the electric locomotive. Considerations of cleanliness and health pointed to the necessary use of electricity as the motive power in the tunnel and it will therefore be interesting to describe a few features in the design of the locomotives selected for the work.

The equipment for the electrification of the tunnel and terminals, for which the Canadian General Electric Company, Limited, have the contract, includes six electric locomotives designed for an operating potential of 2400 volts, direct current, with overhead trolley construction, which has been adopted as the C. G. E. standard for service of this sort. Two of these locomotives, operated and controlled as a single unit, will have ample capacity and suitable speed requirements for handling the heavy transcontinental passenger trains—1130 tons trailing load—within the Montreal terminal zone. A single locomotive will successfully handle the freight trains—1000 tons trailing load—and the local passenger service—500 tons trailing load.

Locomotives

The general type of the locomotive proposed is that known as the Box Cab—Articulated running gear type. The estimated weight of the complete locomotive is 83 tons. The locomotive has four axles with all of the weight of the locomotive evenly distributed over the eight driving wheels, thus securing the maximum adhesive weight on drivers. The running gear consists of two four-wheel trucks, articulated together by a heavy hinge. The equalization of the trucks is accomplished by a heavy locomotive type semi-elliptic leaf spring over each journal box, connected through spring hangers to the frame and to the equalizer bars. Practically a three point suspension is thus supplied through the side equalization of one of the trucks and both side and cross equalization of the other truck. With the Miner friction draft gear mounted in the end frame casting of the truck, this type of construction restricts the hauling and buffing stresses to the truck side frames and articulated joint, instead of through the cab centre plate. This relieves the cab and apparatus from the effect of severe shocks.

Both the box cab and platform are built of plates, sheets, angles and heavy channels and are thoroughly reinforced throughout. The box cab is divided into three compartments; the apparatus compartment in the centre and the two operators' compartments at the ends. Each operator's compartment has a full complement of apparatus, consisting of controller, control switches, meter, air brake control apparatus, air guages, pantagraph control and heaters, thus providing the locomotive with a complete double end control. All apparatus subject to 2400 volt potential is located in the centre apparatus compartment and properly screened to protect against accidental contact. The location and general arrangement of this apparatus is such as to provide easy access from all sides for inspection, cleaning and repairs.



Side view of Locomotive to be used on Mount Royal Tunnel line

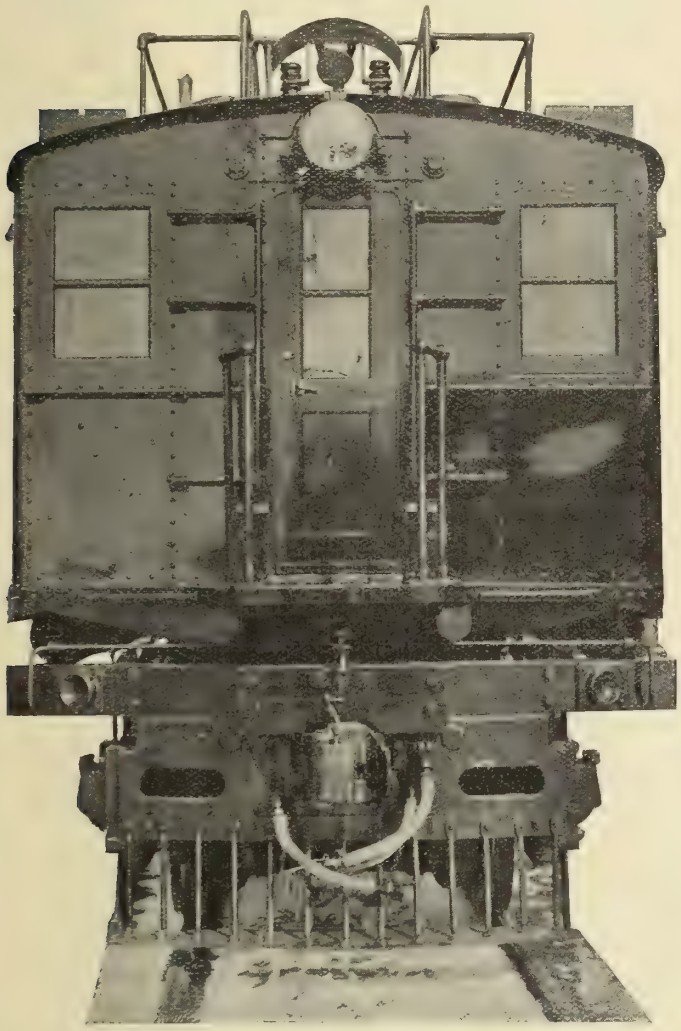
Control Equipment

The well known Sprague-General Electric Type "M" multiple unit double end control equipment is proposed for the locomotives, all the control points being proportioned and adjusted so as to secure a smooth and even acceleration at all times, corresponding to a current consumption near the slipping point of the wheels. The transition between series and series-parallel is effected by a special electro-pneumatically

operated change-over switch and the motor fields will always be on the ground side of the armature.

A motor generator set will supply 125 volt energy for the operation of the control, and a 2400 volt air compressor of 100 cubic feet free air piston displacement is provided as part of the air brake equipment. Two air operated roller pantagraphs and a properly insulated bus line are located upon the roof. The bus line will supply power to two or more units from the pantagraphs of any of these units.

The motor equipment consists of four C. G. E. 229 commutating pole type motors wound for 1200 volts and insulated for 2400 volts, so that two may be connected permanently in series and operated on a 2400 volt circuit. These motors are geared to the wheels through twin gears, there being one pinion on each end of the armature shafts. This motor is specially designed for locomotive service and is provided with forced ventilation by a blower located in the apparatus compartment. The locomotives are geared for a free running speed on tangent, level track of approximately 45 miles per hour and will be operated as two-speed machines with ten points in series and nine points series-parallel.



End view Mount Royal Locomotive.

The air-brake equipment will be the straight air and automatic type so as to combine the desirable features for train operation through an equalizing reservoir and the independent operation of the brakes upon the locomotive. Provision is made for the multiple operation of the compressors upon all locomotives when operating in multiple so as to distribute the duty upon all the compressors in the train.

Operation of Motors

The motors will be operated by the Sprague-General Electric Type "M" two-speed control arranged to operate the motors in series and series-parallel. The external regulating resistance is divided into two parts, each part being direct connected to a pair of motors permanently connected in series. The two pairs of motors, with their resistances, are all connected in series on the first point of the control, the resistance being varied through the first nine points on the controller and finally short circuited on the tenth, or running point. The two pairs of motors are then similarly operated in series-parallel and all resistances cut out on the last or full-speed running point.

A special electro-pneumatically operated change-over switch is used to make the transition between series and series-parallel so that there will be no appreciable reduction in tractive effort during the change. A smooth transition between all points, both rheostatic and transitional, insures motor operation close to the slipping point of the wheels and a steady, gradual acceleration at all times.

The motors have sufficient capacity to slip the wheels, the slipping point serving as a current limit to prevent overloading. Either pair of motors may be cut off, in case of emergency, by means of a special handle on the change-over switch.

Controllers

The master controllers receive their energizing current at a potential of 125 volts from the motor-generator set and provide for operating the contactors so that they close the motor circuits under different combinations and regulate the external motor resistances to give 10 points series and 9 points parallel. The controller is of the non-automatic type and has two handles; one regulating the applied voltage at the motors and the other for controlling the direction of rotation of the motors. Each of the above handles controls a single cylinder.

Pantograph Trolleys

The overhead trolleys are of the pantograph type mounted on insulated bases and pneumatically operated. A hand pump is provided for raising the trolley in case a locomotive has been standing some time and has no air supply.

Automatic Stops

Provision is made for automatically opening the control circuit and cutting off all power from the locomotive, in case the engineer overruns a signal set against him. At the same time a special valve is opened which will set the emergency air brake. The equipments of the motor cars required for this service are also an interesting feature and will be described later.

Subways for Montreal

As the result of further negotiations between the Montreal Tramways Company and the City Council, the former have submitted a scheme which, if carried out, will revolutionize the entire transportation system. It involves the expenditure of many millions by the company and the city. The feature of the proposals is the construction of three underground subways, one almost the entire length of the city north and south, a second east and west under St. Catherine Street, and a short one in the business section. The fare is to be 5 cents straight. The expense of the construction is to be borne by the company, but the city is to guarantee the necessary mortgages to be issued by the company. Subways are also to be built under railways and canals, the company to pay half interest and sinking fund.

It is proposed that a new artery should be opened between Place Viger and Windsor Station, and a boulevard constructed north and south; steps are also to be taken to

widen Vitre Street from St. Denis Street to Victoria Square. The company are prepared to run a motor-bus service, for a 5 cent straight fare, and to run a freight service on the cars at night.

With regard to all surface improvements, the city and the company are to agree that the city supply the streets and the company do the construction work. In exchange for these improvements, the company desire a 40 years' franchise, all existing franchises to be surrendered. The city is to have the right to acquire the system as a going concern at the end of the 40 years by giving 12 months' notice; failing that notice, the contract is to be automatically renewed for periods of ten years. It is also asked that the present percentage of earnings paid to the city be at a uniform rate of 4 per cent. instead of on a sliding scale.

According to Mr. Robert, president, the company will have expended about three million dollars this year in betterments. The intersection rails are superior to those of any other railway system on this continent, and the road bed is absolutely permanent or as near so as the streets of Montreal will allow. In Mr. Graves the company have one of the best engineers in his line on the Continent.

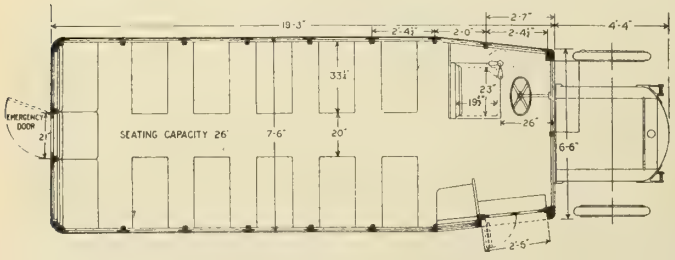
The Canadian Autobus Company have also submitted to the Council competitive proposals for subways.

Twenty-Six Passenger Omnibus

As a feeder to trolley lines and as a means of transportation in sections not served by electric railways, the motor omnibus has no equal. A 26-passenger bus, built by The J. G. Brill Company for the Utica Lines of the New York State Railways, is being used for this purpose, and is at present in service along the New York State Highway between Utica and Sauquoit, a village about ten miles distant. The conditions in this section are ideal for motor bus operation, as there are a number of important manufacturing establishments employing large numbers of hands in the district which, at present, is wholly unsupplied with trolley service. Then, too, the condition of the State Highway permits good running time with none of the racking so common on the ordinary country road.

The bus just delivered is mounted on a special three-ton Mack chassis equipped with Westinghouse air springs at the front and rear. The underframe is formed of the usual side and end sills, properly reinforced, and has as its most interesting feature seven crossings formed of 3-in. channel steel, which are placed with the web in a vertical position, with ash crossings between on which the floor is laid. The use of 3-in. channels in this position reduces the weight of the underframe without taking from the strength.

Door and step arrangements are out of the ordinary in



Plan of 26-passenger motor bus.

this type of vehicle, and permit the utilization of practically the full width of the floor. This is accomplished by means of a two-leaf folding door operated by a lever mechanism at the driver's left hand. This door closes against the edge of the top step tread and the lower step folds up even with the bottom edge of the door. The location of the driver's seat on the left-hand side of the bus, directly opposite to the door, permits of one-man operation, a decided advantage in service of this character.

Standard trolley car practice is followed very closely in the interior fittings. The finish is of ash with maple veneer ceiling. There are 10 transverse seats of Brill manufacture, built without cross frames under the cushions. The pedestals at the aisle ends, together with the cushion supports and seat-back braces, are made of pressed steel in one piece. This method gives strength combined with light weight and facilitates cleaning. Curtains and fixtures, sanitary hand-straps, push-button signal system and seat-back grab-handles are such as are used in regular trolley car equipment. A transverse seat running across the entire rear end of the bus, rattan upholstered like the others, has a removable center-section which gives access to an emergency door.

There are two double sash windows in front, which are particularly interesting in that the lower sashes are stationary while the upper sashes are hinged at the top to open outward. A glass hood, placed at the top of the lower sash in front of the driver, prevents rain or snow from obscuring the section of glass in the line of his vision. All of the side windows have stationary upper sashes, but the lower sashes are arranged to raise. Ventilation is further provided for by four slat ventilators placed two on each side. A single electric headlight is placed under the front projection of the plain arch roof. A row of electric lamps set on either side of the ceiling provide for illumination at night. The bus is heated from the exhaust of the engine. The dimensions of the bus are, roadway to side sills, 3 ft. 2¾ in.; side sills to roof, 7 ft. 2¾ in.; floor to headlining 6 ft. 7¾ in. Roadway to bottom step, 18⅜ in.; bottom to top step, 13 in.; step to floor, 13 in. Weight of body, 3,750 lb.

Britannia Line not Paying.

The Ottawa Electric Railway gave formal notice a few days ago that on and after December 1st an extra fare would be charged to all passengers riding from Holland avenue, the western limits of the city, to Britannia and intermediate points. As a result of an application filed with the Railway Commission, on behalf of the city by Mayor Ellis, asking the Commission to investigate the tariffs of the company and its refusal to make any further extensions of the street railway system in the city before the expiration of the company's franchise in 1923, an order has been issued preventing the increased rates from going into effect before January 1st.

In the meantime arguments for and against the application will be heard by the Railway Commission on a date yet to be fixed. There is a great deal of public interest being manifested over the proposed action of the company, whose directors state that the reason for their action is that the Britannia line is not paying and has not paid for some time.

The O. E. R. has $750,000 invested in the line in question and since the one fare from any part of the city to Britannia, a distance of about six miles from the centre of the city, has been in effect, the receipts have not been sufficiently large to pay the fixed charges, which total annually about $50,000. Though the street railway system as a whole is a paying concern the directors are of the opinion that the Britannia line, which was a separate investment should be put on a paying basis. When the line was opened in 1900 an extra fare was charged from the city limits, but even then did not pay. Five years ago the extra fare was abolished and a fare or transfer from any part of the city was honored on the line and this, too, has proven unprofitable. During the past five years, however, the district through which the line runs has become fairly well settled, but the increased traffic has not brought as large a volume of business as hoped for.

Illumination

Principles of Illumination

III. Absorption

One of the biggest stumbling blocks in the way of efficiency in illumination is "absorption" of the light. Whenever the rays come in contact with a reflecting or refracting material a certain amount of light is destroyed, this amount varying with the material but running often as high as 50 per cent. To understand the real meaning of absorption it is necessary to mention a few facts in connection with the theory of light.

Light is a form of energy, just as heat is, and is carried from its source to the object illuminated by waves of ether. It follows therefore that if we destroy these waves we at the same time extinguish the light. The waves will pass quite freely through clear glassware but a large percentage are killed by frosted, ground or colored glass. Dark or rough

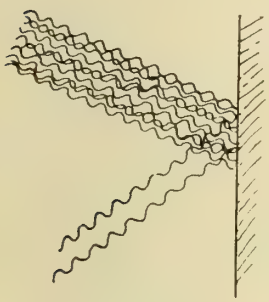


Fig. 1.

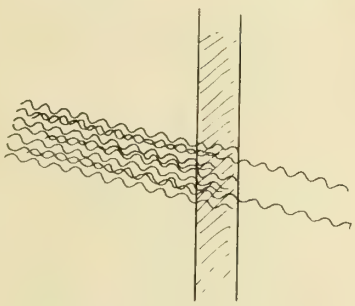


Fig. 2.

surface walls have the same effect. The destruction of waves at either a poor reflecting surface or in an ordinary refracting medium may be represented as in Figs. 1 and 2. It will thus be seen how important it is to decorate our rooms having in view a proper and efficient illumination. We would not expect great efficiency using an indirect unit with a dark or rough ceiling; nor is efficiency possible if we surround the light source with a semi-opaque globe. The better distribution and more artistic effect obtained in this way must always be at a greater expense for current.

More Light for Galt

The town of Galt has just added a number of handsome ornamental standards to their street lighting equipments, samples of which are shown herewith. Figure 1 represents the type of standard used on Dixon street, of which five more have just been installed. Figure 2 represents the type of one light standards installed on Oak street and on Blair Road to the extent of about 70 units. It is expected that the latter type will be used in further extensions along this road as far as the town limits. Galt is also trying out a number of combination trolley and tungsten standards which are giving excellent satisfaction. These standards are 22 ft. high and carry, at a point approximately 12 feet from the ground, 4 spherical globes containing 100 watt tungsten lamps. The poles thus extend about ten feet above the lamps and are used to sustain the cross wires from which the trolley wire is suspended. These combination poles are also to be used for transmission poles, in Galt, by the addition of two steel cross-arms which will carry the 2300 volt distributing wires.

The ornamental standards are fed by underground work. These consist of three wire No. 4 B & S cable, jute insulated

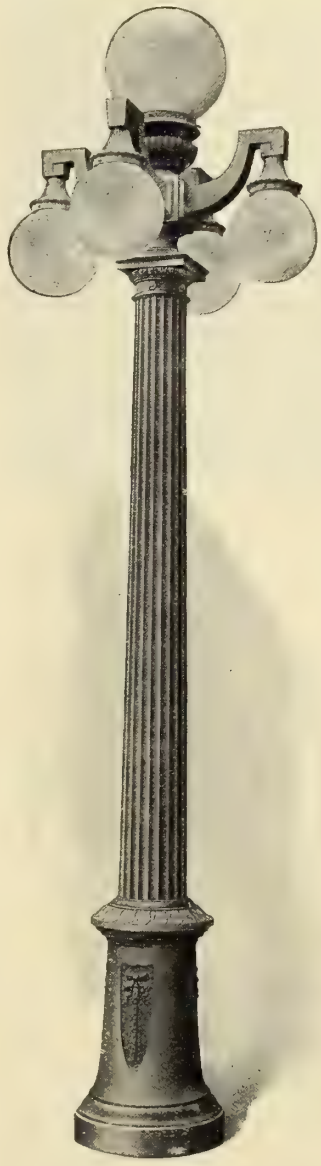


Fig. 1.

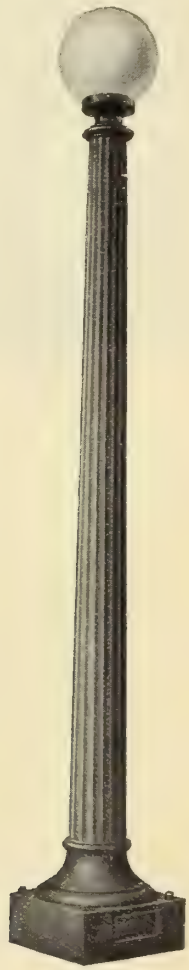


Fig. 2.

and lead covered. The cable was supplied by the Johnston & Phillips Company, of London, Eng. The cable is in turn enclosed in 3-inch diameter fibre duct, which in turn is laid in cement about 30 inches below the surface of the roadway, close to the curb. All lamps are connected in multiple and

remote controlled by time switches located either in manholes or on wooden poles situated in side lanes. Secondary distribution is at 110 volts, 3 wire single phase, all transformers being placed underground in 5-ft. x 6-ft. x 6-ft. manholes, or, in a few cases, 6-ft. x 6-ft. x 8-ft. manholes. The combination trolley and illumination poles are placed from 105 to 115 ft. apart.

Galt's street illumination is one of the finest in Western Ontario, and much credit is due the officials who have had the installation in charge. Mr. R. Elliott is superintendent; Mr. Stuart Scott, manager, and Dr. Deakin chairman of the light and power commission. The standards used throughout are the well-known Luxolabra type.

Book Store Lighting

The photograph herewith, Fig. 1, represents the system of lighting recently installed in Tyrrell's new book store on King Street East, Toronto. The units are the Alexalite indirect, total reflecting type. These reflectors are made of



Fig. 1—Illumination of a Book store

steel and the reflecting surface is glass enamel. The outside surface is also glass enamel but is finished with a dead white finish which makes the fitting highly hygienic; it is claimed also that this finish will not deteriorate in any way,

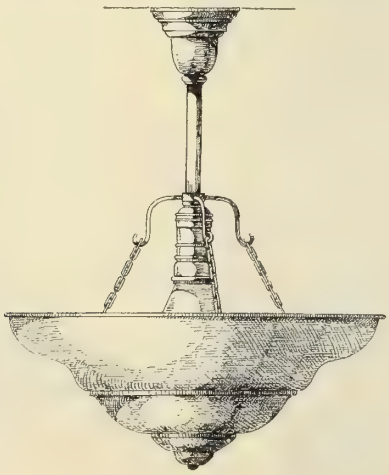


Fig. 2

that mechanical injury is practically impossible and that it can be cleaned without trouble. In certain cases a clear glass cover is supplied to keep dust from collecting in the interior surface and on the lamps.

A typical unit is shown in detail in Fig. 2. The reflector is seen suspended by three short chains, which, however, are not, in general, visible to the observer. The best results are obtained with these units by spacing them about 22 feet apart and well up, but in the Tyrrell book-store, where a specially high illumination was required, the units have been spaced 16 foot centres. Each unit is supplied in this case with one 150 watt tungsten with the result that they have a very even illumination with very high values at every point of the store.

Proper Lighting as a Factor in Accident Prevention

The importance of proper illumination for all work places cannot be overestimated from the point of view of safety. Those who have studied the subject are well aware of the considerable number of accidents resulting annually from defective lighting. Insufficient illumination is frequently held by juries to be "contributory negligence" in accident suits. In defence, the attorneys of one large manufacturing company I have in mind, find it a good plan to offer testimony proving the plant lighting to be sufficient and adequate.

Dangerous machinery should always be well-lighted. It is not of much use to place a guard upon a dangerous machine if the light is so poor that every moving part cannot be distinguished. Many a machine or process that might be considered safe in a well-lighted room becomes extremely dangerous if operated or performed in semi-darkness.

In foundries the insufficient lighting of passages often causes men to stumble over imperfections in the floor; in the case of a worker carrying a ladle of molten metal, a misstep may result in a serious accident.

Good illumination in mines, as elsewhere, is one of the most effective safeguards against accidents. Recent concern has been caused by the spread among miners of a nervous affection of the eye known as nystagmus, which celebrated physicians claim is due largely to the defective lighting of mines.

The cost of accidents throughout iron and steel plants can be directly or indirectly charged to inadequate lighting. The work is fairly hazardous and many of the workers are of foreign birth, unable to read or understand the written or spoken cautions for their safety. An iron and steel plant demands good illumination over a great range, varying from the executive offices to the yards; and where a plant is operated both day and night with a view to doubling its output, it is very necessary that the working conditions at night approximate those of the day. A recent extended study has shown that upon the proper solution of plant lighting problems depends, to a large extent, the amount and cost of production.

Proper lighting in factories not only benefits the employees but the employers as well, who find their insurance rates lessened by a diminished accident risk. The initial expense of installing proper lighting arrangements is very soon offset by the gain in the quality and quantity of the product.

It should be borne in mind that not only sufficient and well diffused light should be provided in factories, but that the lamps should be shaded from the eye and placed so that the direction of light is proper for mechanical operations. Many mishaps are undoubtedly due to the disregard of these principles.

A shop is completely demoralized by frequent accidents. The excitement and lack of security have the effect of making operators inefficient and nervous, while the work suffers. The economic advantage of accident prevention to the employer is therefore apparent, quite apart from the consideration of safety, freedom from strain, and greater efficiency of the worker. Considering proper illumination as a factor of safety, it is safe to say that the adequate lighting of shops and factories would probably prevent 25 per cent. of the avoidable accidents in industry.—Dr. W. H. Tolman in "Lighting Journal."

Influence of Proper Factory Lighting on Work and Workman

The influence of proper illumination both on the quality and quantity of work that can be turned out in a factory is now recognized as being very great. On other pages of this issue we describe in detail the illumination and wiring of a large Canadian factory where the value of proper surroundings for the workman is being already felt. We also print herewith extracts from a paper by Mr. W. Harrison in a current issue of the Electrical World. Mr. Harrison deals at length with the proper design of factory illumination.

"That good illumination in industrial plants is a factor in the cost of production is generally appreciated. It is the purpose of this article to discuss the requirements which must be met in the design of a satisfactory lighting system, to point out methods of design to be followed, and to show cost figures which will be of value to those contemplating the design of a practical lighting system.

There are four general requirements to be met—sufficient light of the proper quality on the work; a moderate intensity over the adjacent area and on the walls; absence of glare, and simplicity, reliability, ease of maintenance and low operating cost.

It is obvious that there must be sufficient light on the work. Better lighting facilities, along with practically all other improvements in industrial plants, are installed for the purpose of ultimately decreasing the unit of cost of production. From an economic standpoint, however, it is very difficult, if not impossible, to determine the proper intensity for a given class of work. This intensity depends upon the cost of producing light, the number and wages of the employees and the value of their output, as well as upon the nature and fineness of the work and the possible reduction in spoilage. Owing to the difficulties encountered in evaluating these quantities, estimates of the intensity of illumination required for any class of work have usually been based on other than economic considerations.

Considered only from the standpoint of safety to employees, 0.25 ft.-candle may, in most instances, be taken as the lower limit of permissible intensity in an industrial plant. The upper limit of needful intensity may be conservatively estimated at from 50 to 100 ft.-candles. Illumination of this order is sometimes required for operations involving fine detail, rapidly moving machinery and black surfaces, such, for example, as are common in the shoe industry. In this connection it must be borne in mind that after the apparent brightness of an object has reached a certain magnitude a further increase of intensity does not appreciably aid vision. The necessary volume of incident light will, of course, depend upon the coefficient of reflection of the object illuminated, but even for fine work on very dark goods intensities of the order of those stated above are considered satisfactory. Such intense illumination is usually required over but a limited area and, therefore, can best be supplied by the use of small lamps and reflectors placed close to the work.

While from 0.25 to 100 ft.-candles may be considered as the extreme range of intensity for artificial lighting in factories, the great majority of installations will fall within much narrower limits, between approximately 1 ft-candle and 6 ft.-candles. Many tables have been published designating the proper intensity of illumination for various classes of work, but this necessary intensity depends so largely upon the nature and distribution of the lighting units and upon local conditions as well as on the work to be performed that such tables should be used only with the greatest caution. Furthermore, as stated above, such estimates are at best merely on what is now considered good practice in plants where illumination tests have been conducted. There is no definite assurance that either a higher or lower intensity of light would not tend toward a more economical operation of the plant. As a matter of fact, the cost of adequate illumination for an industrial plant is so low in comparison with the value of the output dependent upon it that in many cases intensities considerably higher than those now supplied will be found profitable. At present an expenditure of 1 watt per square foot of floor area using an overhead system of tungsten-filament lamps and enameled steel reflectors is considered good practice for machine shops and other locations with similar lighting requirements. This will on the average correspond to an initial intensity somewhat in excess of 5 ft.-candles. Tables which give values of illumination recommended for various locations should be understood as merely an approximate guide.

To insure a satisfactory intensity of light on the work from a general overhead system of lighting, it is in most cases essential to provide light from several directions so that all sides of the objects viewed may be properly illuminated and so that if one lamp burns out, or the light from the unit be intercepted either by the operator's body or by parts of machinery, the resulting decrease in intensity will not be serious. In an installation of a few large units shadows are likely to be pronounced. Furthermore, there is a very decided decrease in the illumination when one lamp is extinguished and consequently the time of many workmen may be lost. A smaller unit will affect a smaller area and this area to a lesser degree.

Uniformity in Illumination

Again, with the lighting system in which a considerable number of units are used over an area, it is less difficult to produce uniform illumination. Where one class of work is performed in a given area, a uniform intensity of light over this area will obviously result in the most economical use of the total quantity of light supplied. With any of the artificial illuminants now available, it is impracticable even to approach uniformity of illumination where the distance between units is greater than twice their height above the work. One and one-half times this height is a more satisfactory ratio. For a given mounting height the allowable spacing of units is constant and independent of their candle-power. From the reasons outlined above it follows that an installation of a considerable number of units of low intensity will usually prove more satisfactory and, in the end, more economical than a system involving a small number of high candle-power illuminants.

A requirement of even greater importance than sufficient quantity of light of uniform intensity of illumination is that the intensity shall be constant. A flickering light produces the same effect rapidly repeated as is experienced when one passes from a dark room into bright sunshine. The efforts of the iris to accommodate the eye to the rapid changes of intensity produce muscular fatigue and nervous reaction which cause discomfort and pain.

In addition to supplying the proper light on the work, a well-designed system of illumination should provide for some light on adjacent objects and on the shafting and belting, as well as on the walls and ceiling. In many shops the intensity, except at a few points, is so low that it is scarcely possible to see one's way about. Such lighting is not only inadequate from the standpoint of safety, but also strains the eye. If the work only is brilliantly lighted and the rest of the room is in comparative darkness, the uneven intensity encountered by the eye in shifting from the work has a tiring effect not unlike that of a flickering light source.

From the psychological standpoint, bright walls and ceiling lend an air of cheerfulness and wide-awakeness to a room which is wanting where the work only is illuminated. If, as in a cotton or a paper mill, the materials are of such a color that they will reflect a large proportion of the light incident upon them, the resulting illumination received on the walls and ceiling will be sufficient to obviate any appearance

of gloom. If, on the other hand, the working surface is too dark to reflect much light in this manner, it may become advisable either to choose an illuminant which directs some of its light toward the ceiling and side walls, or else to provide a few lamps especially for this purpose. Such units would ordinarily be placed close to the ceiling in diffusing envelopes. If the walls and ceiling are necessarily dark, as in a foundry, it is, of course, useless to throw any light upon them. Keeping the walls and ceiling well whitewashed adds materially to the appearance of a shop as well as to the efficiency of the lighting installation.

Glare must be avoided. Glare is commonly defined as "light out of place." To cause glare, the disturbing element need not necessarily be a light unit. Glare may as well be the result of specular reflection from some brightly illuminated surface not far from the line of vision, or even from some polished portion of the work itself from which the image of the light source is reflected to the eye.

Recent investigations indicate that the extent to which vision is for the time impaired by glare depends primarily upon the total quantity of light received by the eye directly from the source, rather than upon intrinsic brilliancy; hence the distance between the eye and the source is of importance. If the source is of low intrinsic brilliancy—that is, if its candle-power per unit of erea is low—the effect of glare usually disappears very soon after the cause is removed. If, however, the source is one of high intrinsic brilliancy, such as the filament of a tungsten lamp or the crater of an arc, it may not only decrease the ability to see during its presence within the field of vision but will also tire or permanently injure the eye. The seriousness of this latter effect depends largely on the distance between the eye and the light source and also upon the brightness of the background against which the source is viewed.

In order that a lighting system may not prove objectionable from the standpoint of glare, it should be designed with a view to the following requirements: First—No source of light of high intrinsic brilliancy should be so located that it can readily be seen, except at a considerable distance. In cases where it is impossible to screen the source entirely, the presence of a brightly lighted background, such as the surface of a reflector, will considerably diminish the harmful effect. Second—No considerable amount of light even from a well-diffused source should be allowed to enter the pupil of the eye directly when it is focused on the work. This usually requires that no light source, unless remote, be visible when the head is inclined toward the working surface. Third—It is desirable that the area within the field of vision be uniformly illuminated; at least, the brightness of any portion of this area should not be materially greater than that of the object under observation. Fourth—Specular reflection should be guarded against so far as possible. Where the position of objects worked upon is fixed and the greater portion of the work is in one plane, lamps can be so placed as to avoid specular reflection in the direction of the eye. In the majority of operations in industrial plants, however, such conditions do not exist, and one should direct his efforts toward producing conditions which will allow the operator readily to shift his position in such a manner that direct reflection cannot reach his eye."

The Valleyfield Power Company is applying for an extension of charter powers to enable it to build an electric railway line from Valleyfield southwesterly through Beauharnois and Huntingdon counties to the provincial boundary; another line from the same place southeasterly through Beauharnois, Chateauguay and Huntingdon counties to the provincial boundary; and another line from the same place northwesterly across the St. Lawrence and the counties of Soulanges and Vaudreuil to the Lake of Two Mountains.

Maritime Notes

Tignish, P.E.I.

An electric plant consisting of a gasoline engine generator and storage battery is being installed here.

Buctouche, N.B.

Mr. J. D. Irving is installing an electric light plant to light his residence and mill. The generator will be operated by a gasoline engine. A storage battery will be installed, low voltage lamps being used.

Digby, N.S.

The Public Utilities Commission have been meeting here recently investigating complaints made by some citizens regarding services supplied by the Digby Electric Company. No decision has yet been given.

Bedford, N.S.

The Sackville River Power Company are installing a steam auxiliary at their hydro-electric plant. This company furnish light for the town of Bedford and also power for the manufacturing plant of J. A. Dunn, Limited.

Moncton, N.B.

Contracts have been awarded the Union Switch & Signal Company for the installation of an automatic block signal system. Three sections of track with a total mileage of 43 will be equipped. The contract price is in the vicinity of $85,000.

Yarmouth, N.S.

The corporation of Yarmouth are installing a motor-driven single stage turbine pump of 700 gal. capacity. This pump will be operated from the power lines of Yarmouth Light & Power Company, who have a ten-year contract covering pumping and lighting for the town.

Halifax, N.S.

The Halifax Electric Tramway Company are putting in considerable additions to their railway generating plant and have awarded a contract to the Canadian General Electric Company for one 500 kw. synchronous motor generator set; also for the complete reconstruction of their direct current switchboard.

Sydney, N.S.

The Cape Breton Electric Company are installing a 400 kw. motor generator set in their Sydney power house. The outfit will be used for operating cars in Sydney. The Canadian General Electric Company are supplying the equipment. A duplicate set is being installed in the reserve junction substation.

Summerside, P.E.I.

The Summerside Electric Company have recently put in operation a new gas engine equipment. The engine is a two cylinder horizontal type of 175 B.h.p. The producer is a 200 h.p. open hearth type. Both engine and producer were manufactured by the Crossley Gas Engine Company. The engine is belted to a 120 kw. C. G. E. 1100 volt generator.

Goldenville, N.S.

The Goldenville Mining Company are now operating their crushing and pumping equipment with electric motors, a hydro electric plant having been installed. The generators are 200 kv.a. capacity each and operate at 2200 volts, 3-phase, current being stepped up to 11,000 volts and transmitted seven miles to the mines, where it is transformed to 440 volts. The generators are of Westinghouse manufacture. The company have recently placed an order with the Canadian Allis-Chalmers Limited for a hoisting equipment consisting of a single drum hoist having a drum 41-in. x 28-in. with a rope speed of 450 feet per minute. This hoist is to be direct connected to a C. G. E. motor of 75 h.p., 3-phase, 60 cycle, 440 volts with necessary control equipment.

The Dealer and Contractor

The Wiring and Lighting of Canada's Largest Lithographing Establishment

A very complete electrical installation has just been placed in operation in the new Rolph & Clark lithographing factory on Carlaw Ave., Toronto. Incidentally it may be mentioned that this is the largest lithographing and engraving establishment in Canada and one of the largest on the continent. It is roughly calculated that the cost of the electrical installation with the machines involved, which does not include any generating equipment, will alone be in the neighborhood of $55,000. The building is constructed of steel, brick and concrete, with no wood, a condition which adds considerably to the difficulties of the electrical contractor.

The current is supplied by the Toronto hydro-electric system at 550 volts, 25-cycles, through underground conduit entering the factory immediately behind the switchboard. The 550 volt cables pass direct to a meter box which contains the meters, main switch and fuses, as well as current transformers. This meter box is fitted with metal sliding doors making it fool-proof as far as possible.

The current used throughout the factory is, for the most

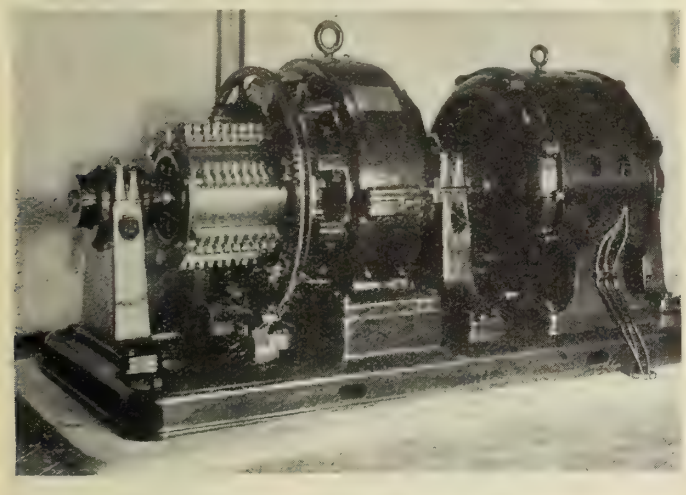


Fig. 1—Motor-generator set, 550 a.c. to 110 d.c.

part, direct for motors, lighting, photography and electrolytic processes. For the necessary transformation a motor-generator set has been installed, Fig. 1, 150 h.p. capacity, which changes the 550 volt, 25-cycle current to 110 volts direct current. From the generator the cable leads are carried in conduit, under the cement floor to the main distributing switchboard. All distribution is in conduit. There are 40 main feeders leading out from the switchboard, carried in conduit varying in size from 2 in. to 4 in. diam., the feeders ranging from No. 4 cable to 900,000 c.m. cable. These are all carried down through the cement floor immediately behind the switchboard and distributed over the factory area. Conduletes are used throughout wherever a turn is required.

As a large portion of the energy is to be used for operating motors at different points throughout this large factory

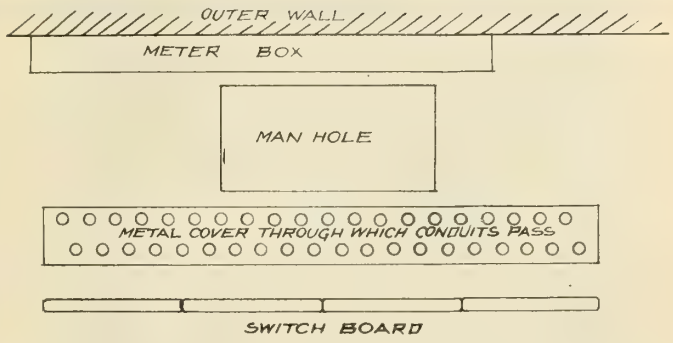


Fig. 2

the conduit pipes were run out from the switchboard to the approximate location of these machines, this being done before any concrete was poured. When it had been definitely decided just where any particular motor would be placed, a hole was drilled through the concrete floor and the conduit extended to that point and up through the floor to the motor. There is no basement under the greater part of the building but sufficient space was left under the floor for the workmen to make the necessary connections.

The conduits which carry the lighting wires are run under

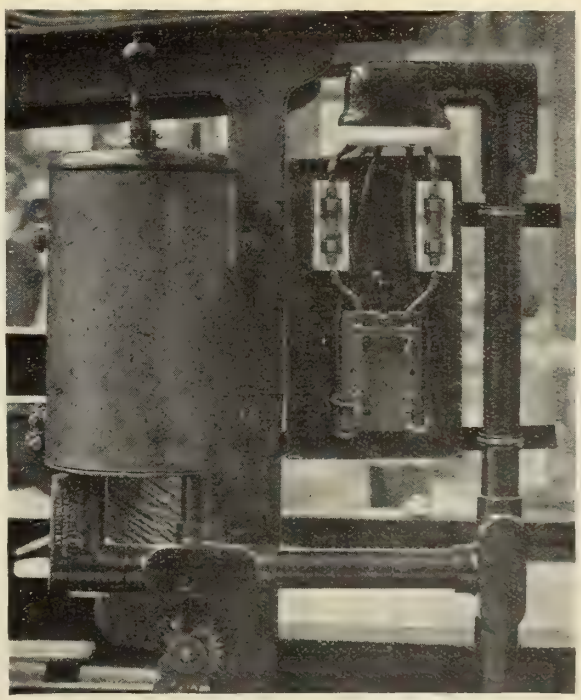


Fig. 3—Typical motor installation.

the floor in the same way and brought up along the walls to panel boxes placed at different points.

The arrangement at the back of the switchboard where the conduits pass down through the floor is novel and par-

ticularly worthy of mention. Each conduit terminates in a coupling which is carried six inches above the floor level, with a condulet bushing. Instead of the usual open space when conduits are brought up through the floor, the opening has been covered with a metal plate about 9 ft. long by 12 inches wide by ¼ in. thick, which sets in the floor flush with the surface and has been drilled with holes to accommodate the 40 odd conduits used for the different circuits. This

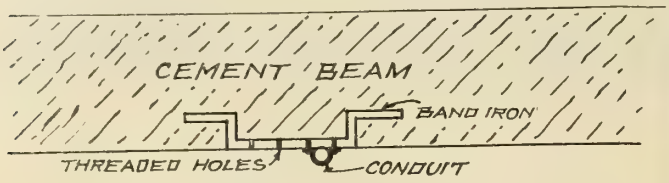


Fig. 4—Conduit under cement beams.

makes the installation dust and vermin proof, ensures good earth contacts throughout and adds greatly to the neat appearance of the power room.

Another feature which is simple in itself, but which helps considerably in expediting the work of making changes behind the switchboard, is a good sized manhole covered over with a hinged metal door. This manhole is of such a depth that workmen can stand in it and make splices or changes on the back of the switchboard in comfort. The diagram herewith ,Fig. 2, indicates the relative location of the switchboard, the conduit plate described above, the meter box and the manhole.

As an extra precaution, two 3-phase, 25 cycles, 20 kw. each, lighting transformers, 550/110 volts, have been installed. These are placed under the floor where they are out of the way and cool. They may be used for lighting either (1) in case of trouble in the motor generator set, or (2) if the latter becomes over-loaded, or (3) when it is not necessary to use the motor-generator for power purposes.

The switchboard is of marble and contains four panels equipped with the usual instruments, switches and circuit breakers.

The power room is entirely enclosed on two sides by

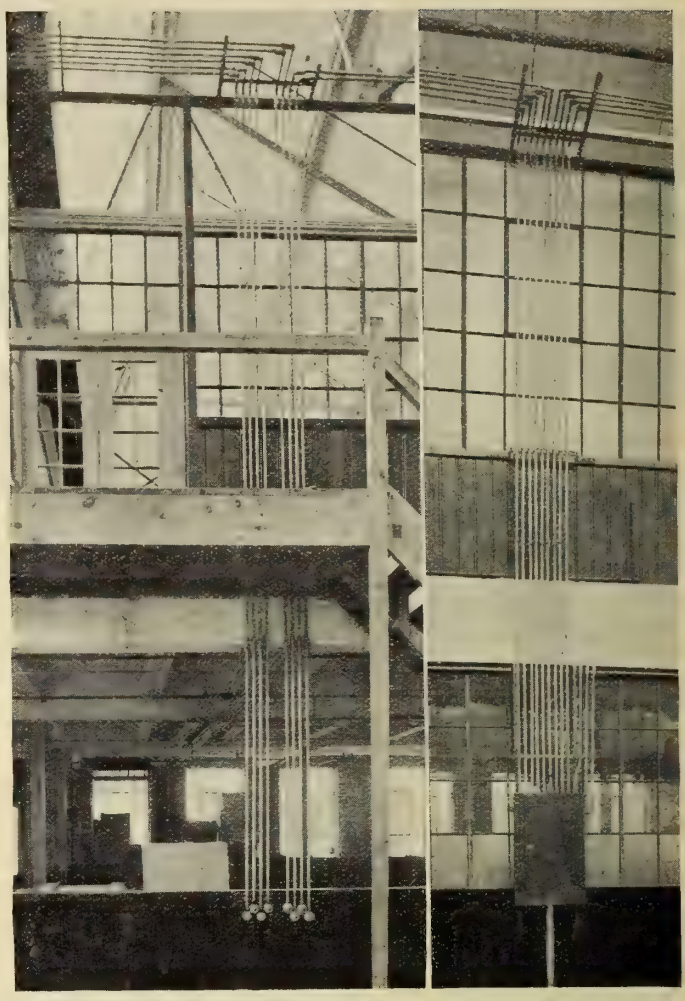


Fig. 5 **Fig. 6**

Figs. 5 and 6—Typical views of wiring—Conduit and condulets are used throughout the building.



Fig. 7—Main section of factory. 150 watt units placed 15 foot centres, 16 feet from floor.

glass, set in iron frames. This room is laid out in such a manner that the capacity can be doubled without any additional expense beyond the cost of the equipment.

The Motors

In all there are some 65 motors ranging in size from 3 to 10 horse-power. Very great care has been taken in connecting up these machines, having in mind their operation by entirely inexperienced and possibly careless workmen. The leading-in cables are enclosed in metal conduit right up to the controller and again from the controller to the motor, removing absolutely all danger to the operator. A typical installation is shown in one of the accompany photographs, Fig. 3, which indicates at the same time the safety-factor and the standard of neatness observed throughout the entire installation.

The Illumination Conduits

For illumination of the various sections of the factory eleven cables, carried in conduit under the floor, feed the same number of panel boards placed at various points on the exterior walls. Each panel board accommodates from eight to sixteen circuits controlled by snap switches installed on the panels. From the panels outward all conduit is exposed, though, being installed with great care and neatness, it is very inconspicious.

As all interior structural work is either metal or concrete the method of attaching the conduit is of interest. When the forms were placed for the beams, and before any concrete was poured, the precaution was taken to place, in their proper position, strips of ⅜ inch x 1 inch band iron shaped as in Fig. 4. Four holes had previously been bored and threaded in each of the straps, as shown, so spaced that three pipe lines, if necessary, could be held side by side by pipe clips which, in turn, are held to the inset band iron by machine screws. Fig. 4 will give a general idea of the scheme, which has worked out very satisfactorily. The holes in the band iron were temporarily filled with putty to keep the concrete from setting in them.

In the main part of the factory, where the larger machines are placed, only the steel framework is available for carrying the conduits. In this case the steel frames were bored and the tubes connected to them securely by pipe clips and bolts. The outlet boxes are also bolted to the trusses. A typical view of the conduits distribution work is shown in Figs. 5 and 6.

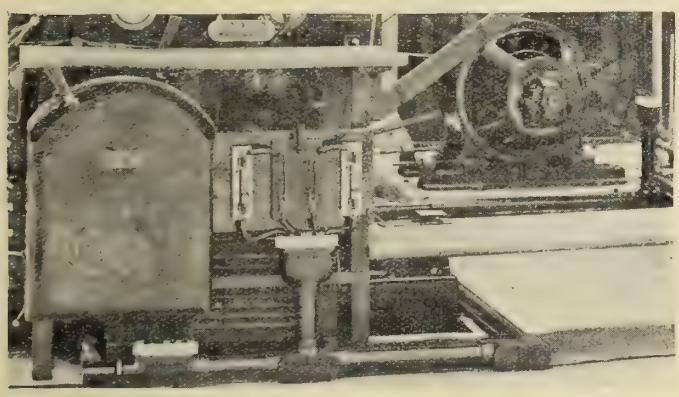


Fig. 8—Typical conduit leads to motors.

The Lighting

As the factory will often operate at night special attention was given to illumination. Fig. 7 is a view of the main section of the factory before the machines were installed and shows the type of unit used and the plan of distribution adopted. One hundred and twenty-six 150 watt lamps, spaced 15 feet centres and 16 feet from the floor and backed by wide diffusing steel Holophane reflectors are suspended by bronze chains from the steel work. This gives an excellent distribution almost entirely devoid of shadows and illuminates every part of the various machines. This part of the factory includes the press room, finishing room, bronzing room and drying room. These lamps are all controlled by snap switches placed at convenient points.

The smaller departments of the factory are lighted, for the most part, by 100 watt lamps, with Moonstone shades, suspended from the ceiling by chains or tubing. In the transfer department and artists' rooms each man is supplied, in addition, with a drop light and a portable. In the main offices semi-indirect units are being installed. The photographers' room is fitted with arc lamps for photographing purposes as well as with general illumination.

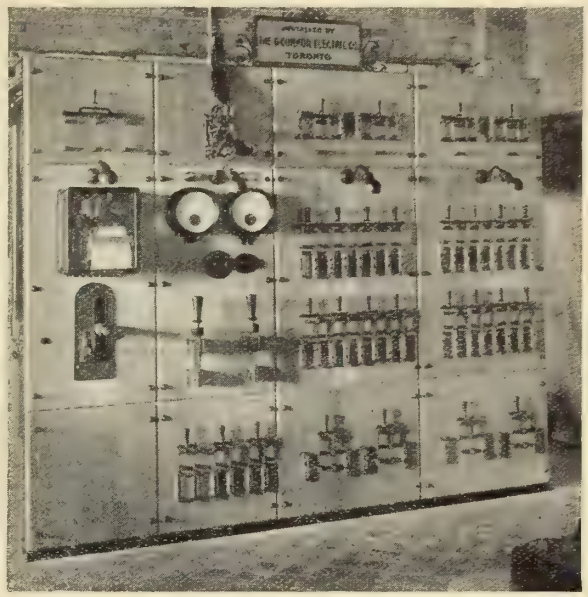


Fig. 9—Main Switchboard.

The electrical equipment in the factory was supplied as follows:—motor-generator, switchboard, transformers and motors, Canadian Westinghouse Company; panel boards and condulets, Crouse-Hinds Company; conduits, Conduits Company; lamps, Sunbeam Lamp Company; reflectors, Holophane Company; arc lamps, MacBeth Company; motor-controllers, Cutler-Hammer, Carpenter type; cable and rubber covered wire, Imperial Wire and Cable Company; Sproat & Rolph were the architects for the building.

The entire electrical installation was planned and carried out by the O'Connor Electric Company under the direct supervision of Mr. F. E. O'Connor, president of the company.

Large Turbine Pump Order

The Abitibi Pulp and Paper Company have just placed an order for electrically driven turbine pumps with Canadian Allis-Chalmers Limited. It includes two high lift turbine pumps for ground wood stock, each 4,000 U. S. gals. per min. against 116 ft. head, 200 B.h.p.; two high lift turbine pumps for grinder pressure supply, each 450 U. S. gals. per min., 231 ft. head, 40 B.h.p.; and one high lift turbine pump for mill water supply 4,000 U. S. gals. per min., 173 ft., 250 B.h.p. There will also be two 14 in. centrifugal pumps for white water supply each 4,000 U. S. gals. per min., 35 ft. head and 75 B.h.p., and two 4 in. centrifugal pumps for slivers, each 500 U. S. gals. per min., 20 ft. head, and 8 B.h.p. All these pumps will be driven by Canadian General Electric motors.

It is understood that the plans of the Forest Hill Railway Company are practically completed and will be ready for submission to the York township council at an early date.

Sectional Book Case Idea Applied to Battery Charging Panels

Owing to the steady increase in the use of electric passenger and commercial vehicles, charging stations are called upon at frequent intervals to increase the capacity of the charging equipment. Because of this it is advantageous to install equipment to which additions can be made easily and economically. The new universal unit type charging panels made by the Cutler-Hammer Manufacturing Company are made up of self-contained rheostats assembled in frames in much the same way that the present day efficient sectional filing cabinets or book cases are assembled, each standard panel accommodating any number of sections up to six. Any number of panels can be assembled side by side according to the space available and, regardless of the fact that these may be installed at different times, will have the appearance of a complete equipment installed at one time.

Each Section a Complete Unit

Each charging section is a unit in itself as shown in Fig. 1. It consists of a slate front 24 inches by 10 inches, carrying the rheostat contacts and sliding brush; a low current circuit-breaker, at left side; an instrument switch, at right; a pilot lamp and grid type resistance mounted on the back. Each section is supported by bolts to the frame, and after disconnecting from the bus-bar can be readily removed if these bolts are taken out. For repairs or inspection a section can be taken out about as easily as a drawer or section from a filing cabinet. On the upper left hand corner of the front a card holder is provided in which a card bearing the designation of the charging circuit can be inserted.

The low-current circuit-breaker mounted at the left of the front has a laminated brush main contact and auxiliary arcing points. It is interlocked with the rheostat so that it cannot be closed except when the sliding brush is moved to the position of "all resistance in." It can then be closed and a small magnet which is in series with the charging circuit holds it in this position unless the charging voltage falls to a value less than the battery voltage or in case the service fuses should be blown.

The instrument switch is a three-position switch having "open," "closed" and "reading" positions. When in the "open"

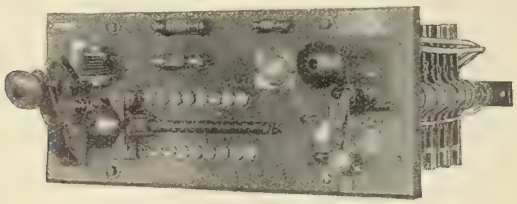


Fig. 1—One of the complete units.

position the circuit to the battery is broken; moving to the "closed" position completes this circuit, and when in the "reading" position the meter, which may be mounted on the top section or on a swinging bracket, is connected in the battery circuit indicating the voltage of the battery. If the low-current circuit-breaker is closed, the current is also indicated on the ammeter scale of the instrument.

The duplex instrument which is furnished combines ammeter and volt-meter and a single instrument can be used for several panels, if desired. The scales are five inches long and thus allow very close readings.

The indicating pilot lamp is a four candle-power candelabra lamp connected directly across the battery leads, and is lighted whenever a battery is connected to the rheostat.

A discharge rheostat can be mounted on the top section to operate in conjunction with the charging rheostat section directly below it. A single pole double throw switch short circuits the discharge rheostat directly to the line. When closed to the right, the switch connects the discharge rheostat in series with the charging rheostat and connection is made so that with the instrument switch closed the battery will discharge.

As can be seen by referring to the illustration, Fig. 3, everything is within easy reach and no operating rods are required. The rheostat being arranged adjacent to the con-

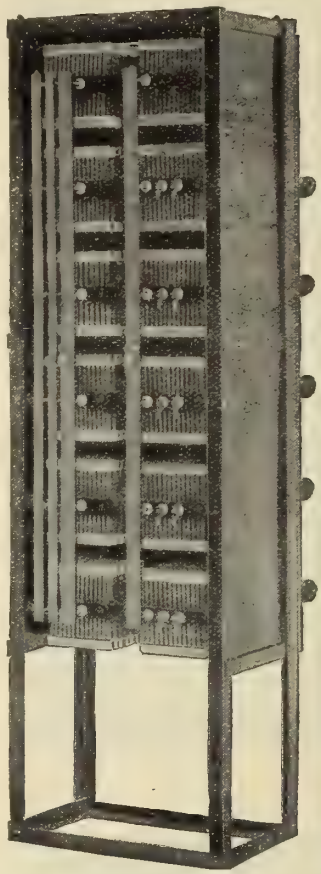


Fig. 2—Rear view.

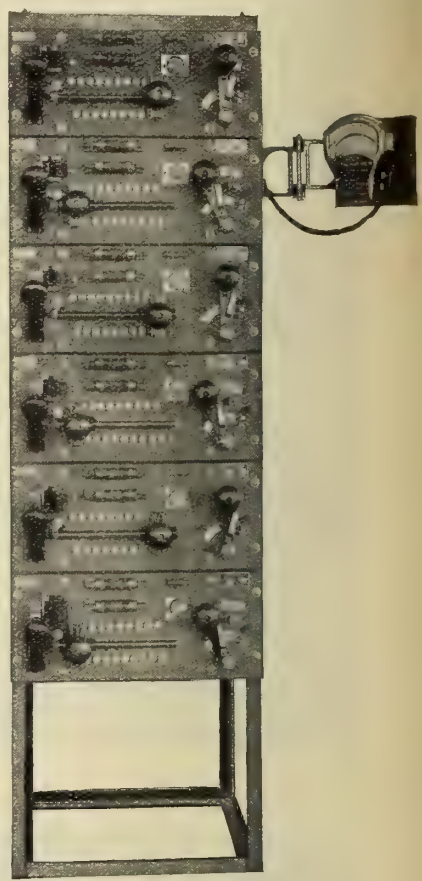


Fig. 3—Front view.

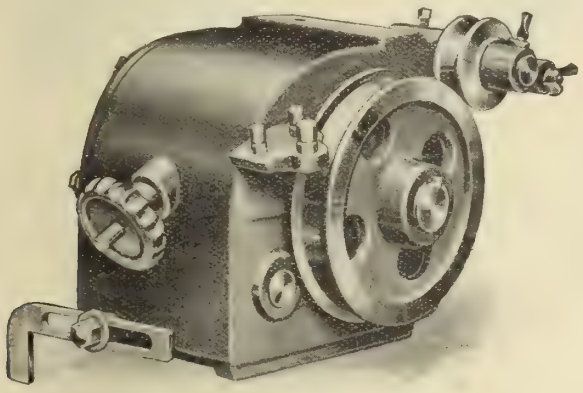
trolling switch eliminates the chance for error in operating the wrong rheostat. Meter readings are made without opening the charging circuit. The voltage and current may be read at any time by moving the corresponding instrument switch to the "reading" position. It is not intended that more than one of these switches be operated at one time but should anyone through ignorance move two at once, no damage will result, as by a special arrangement of the voltmeter connections, the cross currents resulting are made ineffective. When it is desired to stop the charge, the circuit is opened by moving the instrument switch to the "open" point, the arc formed on opening the circuit being taken on the auxiliary contacts which are provided with magnetic blow-out. This opening of the circuit de-energizes the low current circuit breaker which opens, disconnecting the battery from both sides of the line. When the plug is removed from the vehicle, the charging cable is entirely dead.

The rear view, Fig. 2, shows the simple connection arrangements and layout. As mentioned above the fact that the electric vehicle business is still in its infancy makes it particularly necessary that the charging equipment of the garages should be of such design as to allow additions to be made easily and economically. The sectional bookcase idea of standard unit type rheostats that can be assembled in any quantity seems to meet the requirements of not only the present but also the future.

Armature Band Wire Tension Machine

A new portable band wire tension machine of the Peerless type has recently been placed on the market by the Electric Service Supplies Company to meet the demand for a light portable device, which can be used to the best advantage in connection with an ordinary lathe and is claimed to be equally as efficient as any other method in use for rotating the armature. It is applied to a lathe by simply removing the tool post and inserting a bolt which clamps the machine to the cross slide.

This Peerless type affords a machine of the greatest precision from the fact that the tension can be regulated from the proper tension on the smallest band wire to the breaking strain on the heaviest used. By means of this adjustment the exact tension found suitable can be returned to at any time. This tension remains constant and uniform throughout the



Portable band wire tension machine.

banding operation without the slightest injury to the band wire or the generation of heat. Each pound applied to the brake drum is multiplied by means of gearing to 3 pounds at the band wire drum, which is tapered to compensate for the tendency of the wire to crowd up against the flange. On account of this gear reduction, a comparatively small braking effect produces a very great tension on the band wire, and any change in tension can be instantly secured by regulating the hand nut directly in front of the operator.

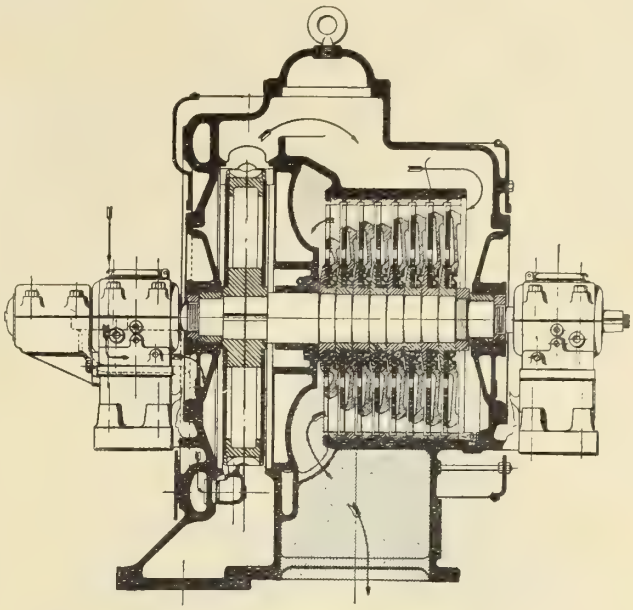
The Peerless portable band wire tension machine weighs 40 pounds complete, making it easy to handle and to adjust in a lathe. The gears, brake bearings, etc., are of ample strength, with large bearing surfaces, and are totally enclosed within the casing, which protects them and avoids possibility of injury to the operator. All bearings are readily lubricated from the outside by oil holes through the shaft.

New Type of Condensing Turbine

The illustration herewith illustrates a design of the latest type of Terry condensing turbine. The machine consists essentially of a multi-velocity wheel as the high-pressure element and a low-pressure end consisting of several multi-pressure impulse elements. The main feature distinguishing the arrangement of this low-pressure element from that used in other types, lies in the fact that it has been turned end for end, receiving steam at the end farthest from the high-pressure element and exhausting into the condenser connection at the centre of the turbine. By this simple device of reversing the flow of steam and thus protecting the vaccuum gland, the old trouble of air leakage has been eliminated.

This turbine has the regular Terry characteristics, including casing split on the axial plane, permitting examination of the runner without disturbing steam or exhaust connections. It has the Terry indestructible high-pressure element which permits starting up the turbine from cold, even though a large quantity of water is thus thrown through the blades. This is done regularly, without any danger from water hammer or any apprehension as to stripping of blades.

The stationary buckets in the low-pressure end are placed on annular rings, from which they may be removed in blocks as necessary. These rings are not fastened to the casing, but



Terry condensing turbine

are bolted together and remain with the runner when the casing is removed. They are held by friction to the casing when the upper half is drawn down tight to the lower half and hence, always retain their position when the turbine is running. This arrangement makes it very simple to examine all parts with a minimum of trouble. This new design of turbine is being supplied to three principal uses:—Driving electric generators, blowers and centrifugal pumps.

Electric Light and Motor Wiring

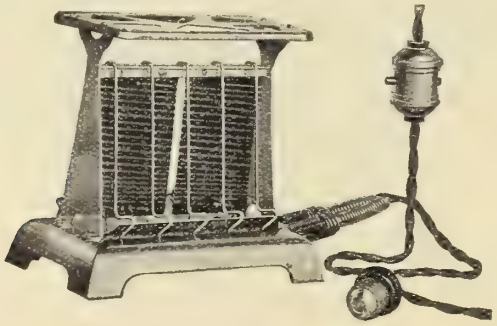
A new vest pocket book entitled "Electric Light and Motor Wiring," by Geo. J. Kirchgasser tells in plain English how the various systems of wiring are installed such as the open knob, moulding, metal moulding, knob and tube, flexible and rigid conduit and armored conductor systems. Over 150 illustrations and diagrams aid in making the descriptions clear. This book has several distinctive features. It does not simply develop the National Electrical Code but tells how the installations are made and what the restrictions are for light and motor equipments. Calculation of wire sizes, very complete motor and controller connections, tables, etc., are included in the 270 pages of this book. The small size of this book, only 2¾ in. wide makes it possible to carry it at all times. Another feature is that no advertising was solicited or accepted; the author is a firm believer in advertising but does not consider a text book a good advertising medium. For the electrical worker, contractor, electrical engineer, steam engineer, architect, central station man, student, etc., this book should be of considerable value. The Electroforce Publishing Company, Stroh Building, Milwaukee, are the publishers; price $1.00.

The Burrows Falls Power Company, of Ayer's Cliff, P.Q., has been acquired by the Sherbrooke Railway and Power Company, thus securing the franchise for the supply of commercial and municipal lighting and power in the town. The Sherbrooke Company controls the Eastern Townships Electric, Stanstead Electric, Lennoxville Light and Power, and the International Electric Light Company. The whole system is now connected by a main transmission line of over 35 miles in length.

Vertical Electric Toaster

The rapidly increasing popularity of electrical devices for cooking has resulted in the introduction of a number of economical devices for the table and in the home. One of the latest devices is the Westinghouse electric vertical toaster which has just been placed on the market by the Canadian Westinghouse Company. This little device, shown in the accompanying illustration, besides being beautiful in appearance is exceedingly economical in operation. The toaster is designed and finished for use on the dining room table; all parts are nickel plated and highly polished. It toasts two pieces of bread at once and has a place on the top where the toast may be kept hot.

This toaster has a record of 6,000 hours for toasting. This means it is capable of making eight pieces of toast every day for almost 100 years. The heating element is practically indestructible, being made of nichrome, a non-oxidizing and non-rusting alloy. The high efficiency of this little device is increased by a reflector at the base of the toaster which rests on an insulating asbestos board protecting the base from direct heat radiation or conduction. This construction enables the toaster to be used on an uncovered table without fear of damaging the finish of the wood. It can be used, therefore, wherever there is an electric light fixture.

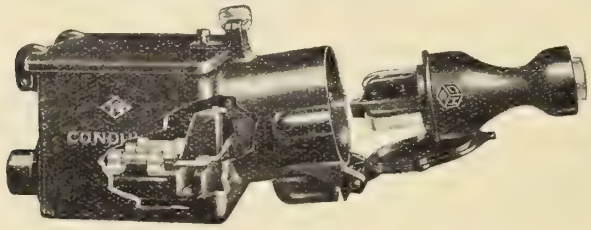


A new toaster

The toaster weighs slightly less than 2½ pounds and is seven inches in height. The current consumption is 550 watts at 110 volts, and two pieces of toast can be made thereon in less than three minutes. The toaster is furnished complete, nickel plated, with a silk cord and attachment plug.

A New Type of Condulet

A new type of condulet has been placed on the market by the Crouse-Hinds Company of Canada. This type is known as the "YQ," and is designed to provide a housing for the combination of plug receptacle and cut-out. They are particularly well suited for use in shops having portable tools, garages, laundries, railroad yards, etc. They are waterproof, and can therefore be installed out of doors. The cut herewith is a broken-away view showing cut-out PE3E and RYQ303 mounted, also plug RQ303 and padlock.

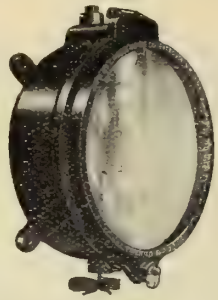


Type YQ condulet

Two types of N. E. C. cut-outs are furnished—plug or cartridge. Plug type can be used on circuits up to 30 ampere, 125 volts. Cartridge type can be used on circuits up to 30 ampere, 250 volts. The door over the cut-out is provided with a spring catch and can be locked with a padlock if desired. The door covering the plug opening is kept closed by a plunger spring when the plug is not in place, thus preventing the entrance of dust, moisture and insects.

New Reflectors

The Crouse-Hinds Company of Canada, Limited, Toronto, Ont., have issued a bulletin devoted to reflectors for use in roundhouses, steel mills, etc. The bulletin also contains instructions as to how and where the reflectors should be mounted so as to give the maximum amount of light where needed. These reflectors are in two general styles. One, type RM, is not unlike an electric car headlight in apeparance, and the other, type RS, is bell-shaped. Both have cast-iron cases and are gasketed, to make them gas, dust and weather-proof. The two cuts herewith illustrate the new reflectors.



Type RM.



Type RS.

Jefferson Glass Extending Operations

The Jefferson Glass Company announce that they are making cut ball globes, electrics, ceiling bowls, and in fact cutting all glassware described in their Bulletin No. 2, at their Toronto factory. They are also putting a decoration on their Moonstone glassware, shown on pages 11, 12, 13, 14 and 15 of their Bulletin No. 1. The colors on this glass are verde green, bronze, old ivory, pink and blue. The "electrics" are decorated to match the dishes and are very beautiful in their tints. This company are also now doing hand decorating and acid etching.

Moving to Larger Quarters

Owing to the increase in their business and the demand for better facilities, the Ferranti Electric Company are moving their Winnipeg offices and warehouse, on December 1st, from 56 Albert Street to the Farmer's Advocate Building, corner of Notre Dame Ave. and Langside Street. A large showroom will be fitted up where samples of all types of meters, transformers, switchboards, instruments, etc., can be seen.

Distributing Samples

The Canada Metal Company are showing their faith in their own products by sending out sample tins of their new soldering paste. We are advised that they are distributing 5,000 packages of their 2 oz. tins as free samples and that this product is meeting with favor wherever it has been tested out.

Mr. H. W. Young, president Delta-Star Electric Company, Chicago, addressed the Illinois Northern Utilities Branch of the N. E. L. A., Dixon, Ill., at their meeting November 21st, the subject being "Selling Power from High Tension Lines," which was illustrated by some forty lantern slides showing many modern outdoor high tension installations.

The Toronto Railway Company have practically completed their extensions on Shuter and Louisa streets, which are expected to relieve the Yonge Street congestion considerably.

Canadian Independent Telephone Convention

The Canadian Independent Telephone Association held its eighth annual convention in the City Hall, Toronto, on Wednesday, November 12th. A number of resolutions were passed, the substance of which were as follows:—(1) that all independent telephone companies purchase their material from manufacturing and supply firms that have no connection with the Bell Telephone Company; (2) that powers at present vested in the Provincial Cabinet by the Ontario Telephone Act be transferred to the Ontario Railway and Municipal Board; (3) that the railway boards of Canada be requested not to approve contracts between independent companies and the Bell Telephone Company unless these contracts contain a clause for direct inter-switching between the different independent companies; (4) that a penalty be imposed where agreements between the independent telephone system and the Bell Telephone Company are not first submitted to the Ontario railway board for approval.

Mr. G. W. Jones, of the Port Hope Telephone Company, was re-elected president, with Mr. Denholm, vice-president. The executive committee consists of Anson Groh, Preston; Ont.; P. R. Craven, Timiskaming Telephone Company, New Liskeard; F. S.Scott, Brussels Municipal System, Brussels; A. Hoover, Home Telephone Company Markham; C. B. Adams, Harrietsville Telephone Association, Harrietsville; D. R. Dawson, Mount Pleasant Telephone Company, Castleton; F. E. Webster, Noisy River Telephone Company, Creemore; M. A. Gee, Erie Telephone Company, Selkirk, Ont.; T. R. Mayberry, Ingersoll Telephone Company, Ingersoll; Auditors, D. R. Beeton, Markham, and G. G. Hoover, Selkirk. Mr. F. Dagger was re-appointed secretary-treasurer.

Calgary Power Company's Extensions

The Electrical News published in the October 15th issue a description of the Calgary Power Company's extensions in which it was stated that it was the intention of the company to erect two additional 55,000 volt transmission lines connecting the power house with Calgary. The paragraph in which this item appeared was not part of the article submitted by Mr. McLeish and was only made to appear so by a mistake of the compositor. We understand from the company that this item is incorrect and that two additional transmission lines are not contemplated.

Montreal Electrical Society

At the regular meeting of the Montreal Electrical Society, held on November 3, Mr. L. E. Hamilton, of the Northern Electric and Manufacturing Company, read a paper on Fire Alarms. Mr. Hamilton gave a brief history of electrical fire alarms, stating that Boston installed the first system in 1851. The invention of the Gamewell system was referred to, the present apparatus being the outcome of improvements made by many people. Mr. Hamilton gave details of installations suitable for a village and for a city of 75,000 inhabitants, and also minutely described the mechanism and working of various forms of the apparatus. The paper was illustrated by a number of slides, facilities for the photographs having been given by the Northern Electric Company.

New Books

The Electric Vehicle Hand-Book—By H. C. Cushing, Jr., and Frank W. Smith, published by H. C. Cushing, Jr., 53 Park Row, New York, N.Y. The object of this handbook is to set forth as clearly as possible the fundamental principles in the operation, care and maintenance of electric vehicles, their batteries, tires, motors, controllers, and accessories. The book is well illustrated and contains a fund of information that will be of the greatest assistance to any one connected in any way with the operation or maintenance of electric vehicles.

The Electric Vehicle Association of America have prepared two booklets:—"The story of the electric pleasure vehible" and "The story of the commercial vehicle," which are being used by this Association in their publicity campaign. These booklets deal with the electric vehicle from both a historical and a practical point of view. In each case actual operation figures are quoted indicating the life of the machines and the cost of operation and the cost of repairs with other interesting data.

It is the desire of the publicity committee of this association to interest central station companies, accessory manufacturers, etc., in ordering a quantity of these booklets from the association to use in their publicity work on behalf of the electric vehicles. On the first issue of the books the cost is 25 cents each, but this price will be reduced depending on the extent to which orders are received; the initial cost of course is higher as it necessarily must cover the expense of the art work, plates, etc. The committee wish to emphasize that these booklets will not be sold at a profit but at the actual cost to the Association.

The judicious use of these booklets by central station companies, manufacturers of accessories, etc., will be of great benefit to the cause of promoting the electric vehicles and will at the same time materially help the work of the Electric Vehicle Association.

Trade Publications

Search Light Projectors—Bulletin 4928A issued by the lighting department of the Canadian General Electric Company on search light projectors for commercial use.

Magnetic Handy Lamp.—A folder issued by R. E. T. Pringle, describing the AB magnetic handy lamp which sticks to any magnetic metal and is especially useful around motor cars.

Radial Switches.—A booklet issued by the Crouse-Hinds Company of Canada, Limited, describing radial switches manufactured by this company, including voltmeter, ammeter and ground detector types.

Condulets.—A folder of the Crouse-Hinds Company of Canada describing and illustrating a type of condulet for every open conduit requirement; also porcelain fittings for condulets, conduit boxes, etc., etc.

Electricity in Iron Foundries.—Bulletin number A4167, issued by the Canadian General Electric Company's power and mining department covering, with illustrations, the application of electricity in iron foundries.

Catenary Construction—A bulletin has been issued by the Ohio Brass Company of Mansfield, Ohio, containing construction details of a number of prominent catenary roads. The booklet is artistically designed, well illustrated and contains a quantity of useful information.

Polyphase Motors.—Bulletin No. 160, issued by the Bell Electric Motor Company, describing their compensated type of polyphase motors. This motor has many new features, one of which is that no compensator or starting box is required. There are two windings on the armature, one known as the squirrel cage winding, of high resistance, and the other underneath this, also of high resistance, which is short circuited before the motor obtains full speed. By means of the two windings, it is claimed that an extremely high power-factor is obtained and also a very high efficiency.

Current News and Notes

Amherstburg, Ont.

The Essex County Light Company are planning certain extensions to their electric light system.

Barrie, Ont.

The matter of an electric railway connecting Toronto, Barrie and Orillia has again been raised.

Battleford, Sask.

The town of Battleford recently contracted with North Battleford for a year's supply of electrical energy at the rate of 5c per kilowatt hour.

Bowness, Alta.

Tenders will be received up to December 31st by the Bowness Improvement Company for a 200 kw. traction motor, one 4 panel switchboard, one 250 kv.a. generator and a gas engine. Mr. T. L. Turnbull, 220 8th Avenue West, Calgary, is the engineer in charge.

Bowsman River, Man.

The Manitoba government telephone department have now reached this point with poles and wires. In a few days telephone connections will be given with Swan River, Kenville, Durban and Benito.

Brockville, Ont.

Tenders have been called for an electrically driven turbine pump for the water and light department.

Chilliwack, B.C.

At the annual meeting of the Chilliwack Telephone Company a dividend of 4½ per cent. was declared, as compared with 8 and 10 per cent. in previous years. Larger expenditures in renewals and rest account additions are stated to be the main causes for the reduction.

College Bridge, N.B.

The power plant of the St. Joseph's College is being enlarged and remodelled. Two direct connected 125 volt direct current sets are being installed, also additional boilers, pumps, etc.

Davidson, Sask.

This town will install a small producer gas electric equipment for lighting purposes. The equipment will be supplied by the Canada Gas Producer Company, Barrie, Ont.

Edmonton, Alta.

In the neighborhood of $2,000,000 will be expended by the Alberta government on telephone extension work during 1914. This will include the erection of a large number of exchanges.

The University of Alberta situated in South Edmonton, will, in all probability, be installing an isolated plant in the course of the next twelve months. Data has already been collected.

Fredericton, N.B.

The installation of an electric light and power system in the city opera house is planned.

Grand Falls, N.B.

The town of Grand Falls recently completed the installation of an electric lighting distribution system. The energy is purchased from the Maine & New Brunswick Power Company, Aroostook Falls, N.B.

Grenfell, Sask.

On Monday, November 10th the electric light plant in the town of Grenfell was first placed in commission. The plant consists of a producer-gas electric equipment supplied by the British Canadian Engineering & Supply Company. Mr. George Parley is town electrician.

Guelph, Ont.

The annual report of the Guelph Street Railway Company (municipally owned) shows that gross receipts for the last 12 months were in the neighborhood of $50,000, leaving net profits of $16,000. The assets of the road are placed at $172,866. It is expected that two new cars and a quantity of wire will be purchased in the near future.

Hamilton, Ont.

The dispute which recently arose between the workmen and the G. M. Gest Company over the wage being paid on Hamilton underground electric work has been decided by the Hydro-electric Power Commission in favor of Mr. Gest. While the contract contains a proviso that current wages must be paid it is claimed that this condition is being adhered to.

Humboldt, Sask.

A by-law will be submitted asking authority to expend $20,500 on electric light and power extensions.

Kamsack, Man.

It is reported that the town council have leased the private electric plant of John Simmott and will extend the system to provide street lighting for a number of business houses and residences not now supplied. The town council recently passed a by-law authorizing the expenditure of $25,000 on a new plant, but the debentures have not yet been disposed of.

Lambeth, Ont.

The village council is considering the advisability of having Niagara power brought in for lighting purposes.

Le Pas, Man.

The wireless station at Le Pas point is reported completed. It will be placed in continuous operation as soon as the plant at Port Nelson has been installed. The electric plant for the town is also being put in and it is expected will be operated early in the new year.

London, Ont.

The London Street Railway Company have signified their willingness to give a Sunday service at the rate of seven tickets for 25c and maintain a schedule approximately half as frequent as on other days. This company put their first p.a.y.e. car into service about the middle of November.

Tenders are being called for a storage battery and charging equipment to be used in connection with a fire alarm system.

Megantic, Que.

Tenders are called to January 5th for the construction of a concrete dam in connection with a hydro-electric development for this town. Mr. E. A. Evans is engineer in charge.

Merrickville, Ont.

A delegation of prominent men from Merrickville, Ont., interviewed Hon. Dr. J. D. Reid, acting Minister of Public Works, on November 20th, and urged that the proposed im-

provements to the Rideau Canal be made in such a way so as to provide electric power for the town. Hon. Mr. Reid promised to consider the request very seriously.

Minnedosa, Ont.

The water supply of the hydro-electric plant here was recently interfered with by a beaver colony which had constructed a dam several feet high across a feeder running into Clear Lake from which the supply for the plant is drawn. The normal flow of water was restored when the beaver dam was destroyed.

Malakwa, B.C.

It is reported that a company will be formed here to install a local telephone system.

Medicine Hat, Alta.

The city council have decided to call for alternative tenders on a 1500 kw. and a 2000 kw. electric generating unit, though it is probable the contract will not be awarded for some time.

Moncton, N.B.

At a recent meeting of the city council a committee was appointed to look into the question of installing a plant at the pumping station to light the streets, city buildings and for all civil work.

Montreal, Que.

The Union Switch & Signal Company have been awarded a contract for the installation of an automatic signal system on the Intercolonial railway between St. John and Moncton, N.B.

Mr. Duncan McDonald acting for the Canadian Autobus Company states that their plans are progressing for placing a number of autocars on the streets of Montreal.

At the last meeting of the Montreal Electrical Society, Mr. L. R. McDonald, of X-Rays, Limited, gave an address on "High Frequency Electrical Currents and their physiological effects."

Mr. Walter Fowler has been elected president of the Electric Club of McGill University, in succession to Mr. Dawson, who has been compelled to retire from McGill owing to illness. At the same meeting Mr. W. McN. Forbes, consulting engineer, spoke on "The application of electrical engineering to mining."

After working night and day for over a fortnight, the Bell Telephone Company, Montreal, restored the Main service interrupted by the destruction by fire of the racks below the switchboard room. The occurrence involved 13,000 telephones, and to meet the emergency the company established about 500 public temporary connections. Although the fire was a comparatively small one, it involved a complete equipment of new cables comprising about 50,000 feet of various sizes, and their connection between the main and intermediate distributing frames. The fire is believed to have been caused by the wires coming in contact with a power wire, and the company are making a thorough investigation with a view to preventing a recurrence of the trouble.

The Canadian British Insulated Company, Limited, Montreal, have received an order from the Hydro-electric Power Commission of Ontario for 24,000 ft. of 300,000 c.m. three core paper insulated lead covered cable, for 13,000 volt service. This is a duplicate of the cable already connecting the Hydro-electric Power Commission's step-up transformer station with the Ontario Power Company's power house at Niagara Falls.

New Glasgow, N.S.

The Pictou County Electric Company, as recently reported in these pages, are installing new generating equipment. We are advised that the Robb engine of 700 h.p. has arrived and will be installed immediately. The generator is being supplied by the Canadian General Electric Company. The Pictou County Electric Company have also on order two new passenger cars which are expected to be ready for delivery about January 1st.

North Bay, Ont.

Sudbury and North Bay have made a further request to the Hydro-electric Power Commission of Ontario for the development of water powers in their district.

Orillia, Ont.

At a recent meeting of the water, light and power commission it was decided to give a monthly rate of 20c net per sixty watt lamp for sign lighting.

Owen Sound, Ont.

It is understood that work will be commenced at an early date on the development of Eugenia Falls for supplying power to Owen Sound and the neighboring district. The total expenditure will probably run as high as $300,000.

Prescott, Ont.

An arrangement has been reached between the town and the Bell Telephone Company by which the town is permitted to use the poles of the telephone company along King Street for the purpose of stringing electric wires. The company makes a charge for this privilege of 75c per pole per year and the town will also be required to pay a portion of the maintenance charges.

Preston, Ont.

A by-law will be submitted to the ratepayers on December 15th for the expenditure of $18,000 on alterations and extensions to the electric light system.

Peterboro, Ont.

The plant of the Quaker Oats Company, Peterboro, has been equipped with an inter-communicating telephone system.

The Electric Power Company recently refused the city's offer of $95,000 for their distribution system in Peterborough. The city council have appointed Mr. R. A. Ross, of Montreal, as their arbitrator in the proceedings which will follow.

Point St. Charles, Que.

A contract for the supply and erection at the low level pumping station, Point St. Charles, of a 35 kw. direct current generator for electric lighting has been awarded by the city of Montreal to the Siemens Company of Canada, Limited.

Rainy River, Ont.

The Canadian Westinghouse Company have recently supplied Mr. W. H. Green, of Rainy River, with the following equipment:—two 50 kw. revolving-field, belt-driven generators, 3-phase, 2200 volts, 7200 alternations, complete with field rheostats; one 2 kw. 125 volt exciter, 1700 r.p.m.; one 4 panel black marine slate switchboard consisting of 2 generator panels. The four panels form one complete board with gas pipe frame to include one set of bus bars mounted on the top of the panel.

The E. Leonard & Sons recently supplied this plant with a 13-in. x 12-in. automatic engine which is a duplicate of one supplied by the same company in June, 1909. Steam for the two engines is supplied from two 72-in. x 16-ft. stationary return tubular boilers supplied by the same company. The E. Leonard & Sons also supplied one 26-in. pressure heater for use in connection with this plant.

Regina, Sask.

The suburban railway line, being financed by the Country

Club, is practically completed but the municipality of Sherwood through which it runs is very much opposed to its operation. It appears the consent of the municipality was not obtained before the work was done.

Tenders are called for automatic air-pressure force pumps, electrically operated, to regulate the water pressure at certain points in the city.

The operating returns of the municipal street railway system for the week ending November 8th are:—revenue, $4,289; passengers carried, 100,000; passengers carried, including transfers, 113,944. For week ending November 15th corresponding figures were $4,463; 109,767, and 125,034.

Red Deer, Alta.

At the annual meeting of the Western General Electric Company held here on November 19th it was decided to increase the capital to $500,000 so as to be in a position to meet the increased demand for light and power.

Rossland, B.C.

The Rossland Water & Light Company, Limited, recently decided to adopt the meter system of charging for electric lighting in preference to the flat rate now in vogue. The present rate of 50 cents per light per month will give place to a meter charge of 10 cents per kilowatt hour. The company announces its intention of allowing one year for the complete change of its system, work to be started immediately in the commercial section of the city, the residential districts following later. Following is the new scale of lighting rates proposed: Up to 100kw.h. monthly, 10 cents per kw.h; from 100 to 200 kw.h., 9 cents; 200 to 300 kw.h., 8 cents; 300 to 400 kw.h. 7 cents; 400 to 500 kw.h., 6 cents; 500 to 2,000 kw.h., 5 cents; 2,000 kw.h., 4 cents. In addition to the above, a meter rental of 25 cents per month will be charged for every meter up to a capacity of 20 amperes. Over 20 amperes capacity and up to 40 amperes, 50 cents per month per meter, with the usual government testing free.

Salmon Arm, B.C.

The new electric plant was placed in operation on November 6. DuCane, Dutcher and Company were engineers for the town.

Shoal Lake, Man.

An electric light by-law will be submitted to the ratepayers on January 1st.

Smith's Falls, Ont.

A new 275 kw. generator was recently placed in commission in the plant of the Smith's Falls Electric Power Company. This now brings the generating capacity of the company to over 1000 h.p., the machines being so arranged that they may be driven either by water power or by steam. Mr. Ross O'Hara is superintendent of the plant, and Mr. Geo. B. Frost, manager.

Saskatoon, Sask.

The city has awarded a contract to the Canadian Westinghouse Company for two electrically driven turbine pumps. The pumps will be of the De Laval type and the motors will be of the Westinghouse induction type.

Sherbrooke, Que.

The following is the Sherbrooke Failway & Power Company's statement of gross and net increases for the four months ending October 30th, 1913: gross increase, $7,805.62, 17.9 per cent.; operation increase, $3,519.11, 13.7 per cent.; net increase, $4,286.51, 24 per cent. The company have also entered into contracts for the sale of an additional 1500 h.p., which will come into force during the next three or four months.

South Vancouver, B.C.

The ratepayers of South Vancouver are giving hearty support to a petition which is being circulated throughout the district, asking the council to submit a by-law which will provide for the construction of a municipal electric lighting and power plant, preferably on the North Arm of the Fraser River, at a cost of approximately $300,000. While the council is at present averse to supplying any details in connection with the project it has been learned that the municipal electrical engineer Mr. L. F. Rawden has prepared plans for the installation of an extensive power plant, as well as for a complete system of distribution in anticipation of the proposed by-law being submitted to the property owners, and favorably voted upon, in the near future. The municipality will sell light and power for rates as low as is consistent with the initial outlay on the plant and its upkeep.

The municipal council have been advised by their engineer to consider the installation of a new system of street lighting.

St. Thomas, Ont.

The London & Lake Erie Transportation Company are planning extensions to their lines in a number of directions.

St. John, N.B.

On November 11th the street cars commenced running on Haymarket Square to Kane's Corner, at the Junction of the Loch Lomond and Russell Streets. The new loop around Russell Street is not yet completed, but work is being pushed forward.

Mr. H. M. Hopper, general manager of the St. John Street Railway, N.B., states that the car line will be extended to Crouchville before July 1st, 1914, and that the company is willing to extend to Little River as soon as the highway bridges are strengthened. These extensions are on the Courtenay Bay side of the city and in the vicinity of the extensive dry dock, wharves, etc., being built by the Government.

South Bolton, Que.

Mr. M. Houldsworth will require equipment necessary for a small steam electric plant which it is his intention to install in his mill.

Sudbury, Ont.

Two by-laws will be submitted on December 1st authorizing the expenditure of approximately $18,000 on the extension of the power house and pumping station and the electric lighting system. This money is to take care of extensions that have been already put in.

Swift Current, Sask.

A by-law will be submitted on November 22nd authorizing the expenditure of $15,000 for a fire alarm system.

Three Rivers, P.Q.

The city of Three Rivers have passed a by-law covering compulsory inspection of electrical work by the Canadian Fire Underwriters' Association, who recently opened an office in the city.

Toronto, Ont.

An isolated plant has just been completed in the Sick Children's Hospital on College Street, Toronto. Two units have already been installed of 100 kw. and 25 kw. capacity and have been running since the first week of November. The electrical equipment, including switchboard, was supplied by Messrs. Kilmer, Pullen & Burnham, Canadian agents for the General Electric Company of Sweden. The third unit of 75 kw. capacity has also been ordered and will be installed by the same company. The engines were supplied by Goldie & McCulloch, of Galt.

Further reductions in the price of electric current for

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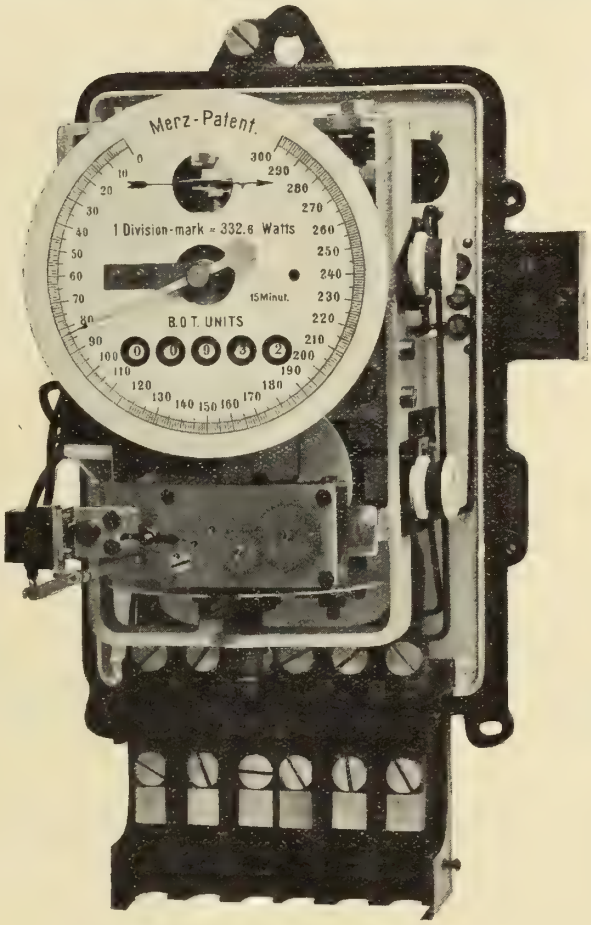
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(Combined Kilowatt hour and Maximum Demand Meter)

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lighting and power uses is foreshadowed in the favorable reports being published by various cities and towns served with Niagara power. It is said that reductions ranging from 25 per cent. downward will be made.

The Ontario Railway and Municipal Board have provided a form of agreement which must be executed in future by the Bell Telephone Company and any other independent company operating in Canada with which they make connections. In the past it appears that the conditions have been more or less variable. By the new order of the board it is hoped that the contract form will be standardized in future.

Mr. R. C. Harris, Commossioner of Works, has recommended a number of new civic electric car lines. It is estimated that the total cost would be in the neighborhood of $1,000,000.

A report will be made on the number of hydro-electric lights required in the Moore Park district.

Mr. P. W. Ellis, chairman of the Toronto Hydro-electric Power Commission, has issued a report to the effect that the power and light departments have together sold 46,000,000 kw.h. during the first nine months of 1913, as compared with 23,000,000 during the same period of 1912, or just double the original amount. It is also pointed out that the cost has only increased from $133,000 to $177,000, an increase of about 40 per cent.

Vancouver, B.C.

It is reported that the Lillooet Light and Power Company will commence operations in the near future on the construction of a hydro-electric plant in the neighborhood of Lillooet.

Recent advices from the provincial forestry department state that the task of laying the government telephone cable between Shoal Bay on Thurlow Island and Heriot Bay, on Valdez Island is proving more of a problem than was at first anticipated; soundings taken along the proposed route indicating a far greater depth of water than previously reported. This cable is being laid in connection with the telephone line on Valdez Island, which communicates with the Dominion government telephone and telegraph line on the mainland, stretching from Vanconver to Lund, a distance of 100 miles. It establishes an important link in the general scheme of telephonic communication throughout the province, which has been planned for the protection of Crown timber from forest fires, and will provide direct communication between Thurlow Island and Victoria, as well as with Vancouver. The cable contains a single pair of wires and is heavily armoured to protect the conductors from damage by water. It is to be laid at a depth of approximately 1,000 feet for three miles, in three stretches, the first of these extending across Okisholo Channel, the second across Nodales Channel, and the third across Cordero Bay. It is believed this will be the deepest cable of any used for fire protection purposes in the world. The confined channels in the vicinity of Valdez Island compel the use of a small launch in the cable laying operations, the equipment on the vessel consisting of a donkey engine, by means of which, with the addition of improvised cable drums and winches, the cable will be paid out.

Victoria, B.C.

A committee has reported to the city council in favor of the erection, on down-town streets, of 15 street clock indicators.

Tenders have been called for the construction of a telephone line connecting the city with Sooke Lake, the source of the city's water supply, a distance of 25 miles.

Operations were suspended for a few days during the second week in November on a portion of the Vancouver Island Power Company's plant at Jordan River, Vancouver Island, following the washing away of the grade along which the flume line runs. The work of repairing the damage was hurried forward with the greatest possible despatch, the construction of a trestle being found necessary at the point where the break in the flume occurred.

During the temporary interruption of the service the company's auxiliary steam plant at Brentwood Bay, as well as the steam plant in Victoria was placed in commission and succeeded in supplying all the necessary power thoroughout the city and the district adjoining.

Verdun, Que.

The Verdun, P.Q., council are asking the Quebec Legislature for power to construct conduits for electric wires.

Watrous, Sask.

A by-law will be submitted asking the authority to expend $8,500 on an electric light plant.

Windsor, Ont.

At the January election a hydro-electric commission will be elected. The members of this commission will likely be paid a salary, the amount mentioned being $600 each.

The city council has recommended the extension of the street lighting system by some 200 lamps.

Winnipeg, Man.

The Central Canada Railway Company will apply for a Dominion charter to construct a railway from Edmonton to Winnipeg, taking in Yorkton, Saskatoon, Battleford and other points along the line.

The city of Winnipeg has awarded contracts as follows:—three 600 kw. transformers to the Canadian General Electric Company; electrolytic lightning arresters, the Canadian General Electric Company; switches to Ferranti, Limited.

Tenders have been received by the Board of Control for a 500 kw. motor-generator set.

An extension of the ornamental street lighting system is contemplated. It is likely that ornamental standards will be installed on both sides of Market Avenue.

The tender of the Suburban Rapid Transit Company, a subsidiary company of the Winnipeg Electric Railway Company, for the lighting of Portage avenue, west of the city limits, has been accepted by the municipality of Assiniboia. This tender calls for 60 arc lamps, not less than two thousand candle power each, at a cost of 20c per lamp per night. All necessary plant and equipment will be installed and ready for occupation by December 18th, 1913.

At a recent meeting of the electrical section of the Winnipeg branch of the Canadian Society of Civil Engineers Mr. C. E. Aldridge gave a demonstration on the pulmotor for resuscitating victims of electric shock.

On December 12th a vote will be taken covering a $1,000,000 expenditure on electric extensions.

Yarmouth, N.S.

The town council are considering the installation of a pumping unit. Power will likely be supplied by the Yarmouth Light & Power Company for its operation, and an alternative steam unit may also be put in.

New Companies

The Three Rivers Traction Company will apply for incorporation for the construction at an electric street railway in Three Rivers and the surrounding municipalities.

The Vaudreuil, P.Q., Electrical Company, Limited, has been incorporated with a capital of $50,000. The main object is to carry on the business of an electric light, heat and power company in all its branches.



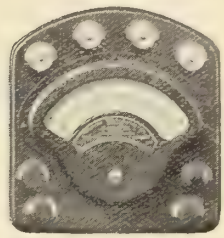
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Voltmeters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters are supplied in single, double and triple ranges.
The Volt-Ammeter comprising six instruments in one.
This group also includes BATTERY TESTERS.



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This new line of instruments represents the latest development of the pivoted moving coil, permanent magnet type for low ranges.

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They embody characteristics which have made the well known Weston Standards famous throughout the world.

They are accurate, dead beat and extremely sensitive.



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They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.

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They have the longest scale ever provided in instruments with equal length of pointer.

Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.

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The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate cost.

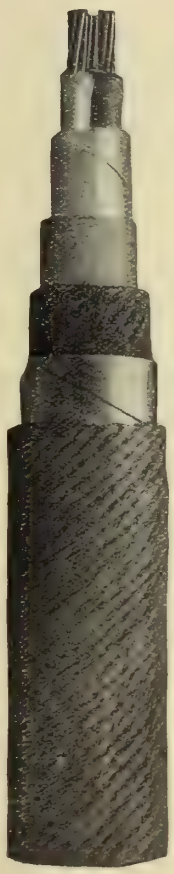
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San Francisco, 682 Mission St.
Cleveland, 1729 E. 12th Street.
Detroit, 618 Union Trust Bldg.
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The lowest tender not necessarily accepted and the right is reserved to reject any or all tenders.

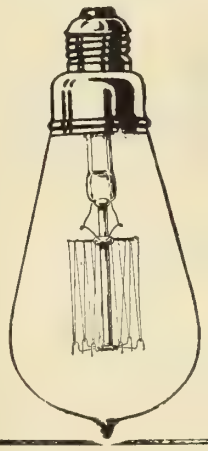
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22-23 Secretary-Treasurer.

LIGHTING SCHEDULE FOR DECEMBER, 1913.

Courtesy of the National Carbon Company, Cleveland

Date.	Light.	Date.	Extinguish.	No. of Hours
Dec. 1	5 00	Dec. 2	6 20	13 20
2	5 00	3	6 20	13 20
3	5 00	4	6 20	13 20
5	10 40	6	6 30	7 50
6	11 40	7	6 30	6 50
8	0 40	8	6 30	5 50
9	1 40	9	6 30	4 50
10	2 50	10	6 30	3 40
11	3 50	11	6 30	2 40
12	No Light	12	No Light	
13	No Light	13	No Light	
14	No Light	14	No Light	
15	5 00	15	8 00	3 00
16	5 00	16	9 10	4 10
17	5 00	17	10 30	5 30
18	5 00	18	11 40	6 40
19	5 10	20	0 50	7 40
20	5 10	21	2 00	8 50
21	5 10	22	3 20	10 10
22	5 10	23	4 30	11 20
23	5 10	24	5 50	12 40
24	5 10	25	6 40	13 30
25	5 10	26	6 40	13 30
26	5 10	27	6 40	13 30
27	5 10	28	6 40	13 30
28	5 10	29	6 40	13 30
29	5 10	30	6 40	13 30
30	5 10	31	6 40	13 30
31	5 10	Jan. 1	6 40	13 30

Total Hours 249 40



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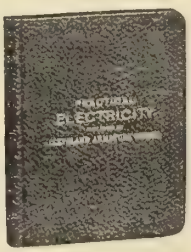
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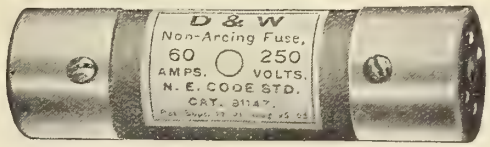
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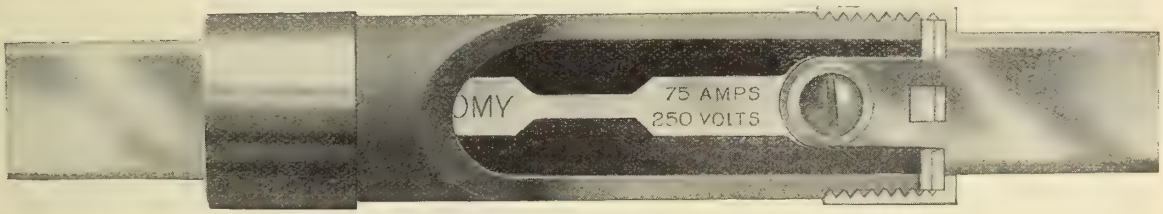
perfection in design, quality in material, and efficiency in operation. Sufficient endorsement of this claim has been furnished by the numerous repeat orders coming in.

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Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
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Electrical Books

FOR SALE

"Tesla High Frequency Coil," by Haller & Cunningham. Published in 1910 by D. Van Nostrand & Company. Price $1.25.

'Elementary Telegraphy," by Pendry. Published in 1910 by Whittaker & Company. Price $1.00.

"Practical Testing of Electric Machines," by Oulton & Wilson. Published in 1909 by Whittaker & Company. Price 75c.

"Wireless Telegraphy Construction for Amateurs," by Morgan. Published in 1910 by D. Van Nostrand & Company. Price $1.50.

'Direct and Alternating Current Testing," by Bedell. Published in 1909 by D. Van Nostrand & Company. Price $2.00.

"A Laboratory Manual of Alternating Currents" by John H. Morecroft, E.E. Published in 1912 by Renouf Publishing Company. Price $2.00.

'Modern Electrical Construction," by Henry C. Horstmann and Victor H. Tousley. Published in 1911 by Frederick J. Drake & Co. Price $1.00.

"Electricians' Operating and Testing Manual," by Henry C. Horstmann and Victor H. Tousley. Published in 1910 by Frederick J. Drake & Company. Price $1.50.

"Telephony," by Samuel G. McMeen and Kempster B. Miller. Published in 1912 by the American School of Correspondence. Price $3.00.

"Elevators, Hydraulic & Electric," by Calvin F. Swingle. Published in 1910 by Frederick J. Drake & Company. Price $1.00.

"Practical Mathematics for the Engineer and Electrician," by Elmer E. Burns and Joseph G. Branch. Published in 1912 by the Joseph G. Branch Publishing Company. Price $1.00.

"The Electric Motor and Its Practical Operation," by Elmer E. Burns. Published in 1912 by Joseph G. Branch Publishing Company. Price $1.00.

'Alternating Currents Simplified," by Elmer E. Burns. Published in 1912 by the Joseph G. Branch Publishing Company. Price $1.00.

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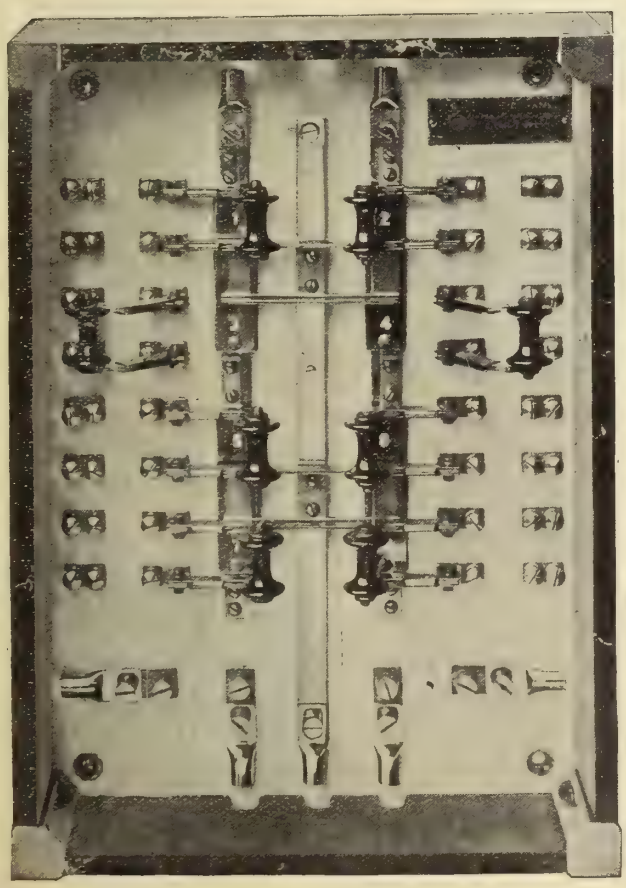
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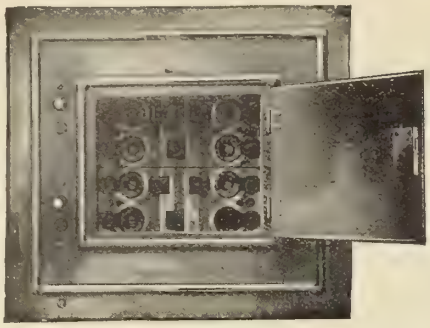
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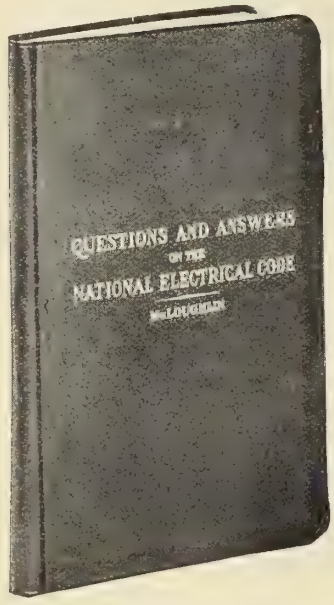
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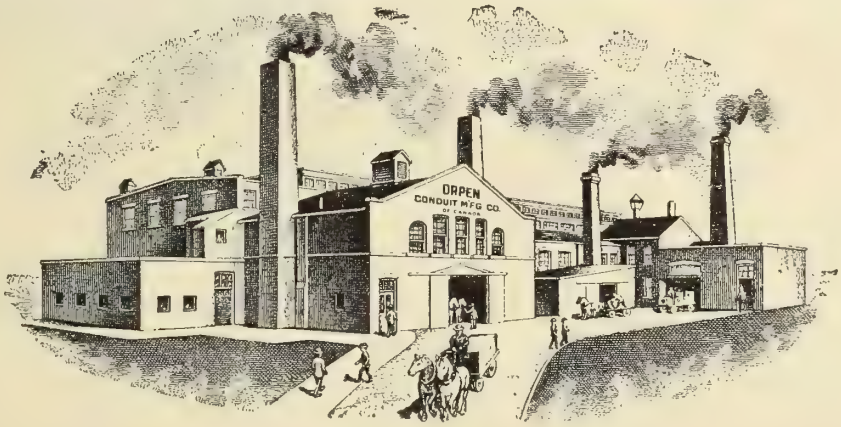
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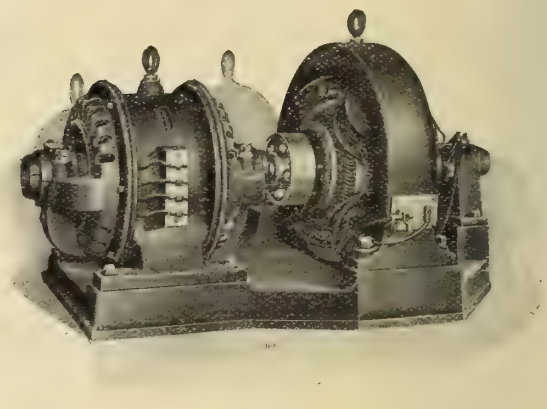
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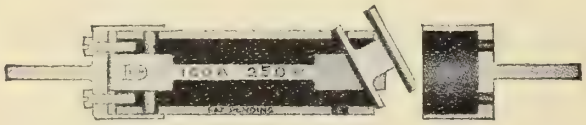
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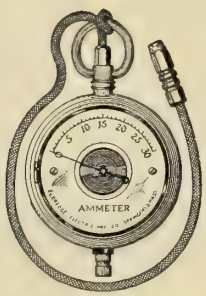
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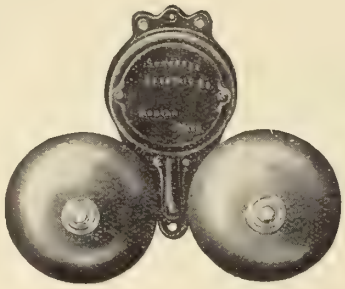
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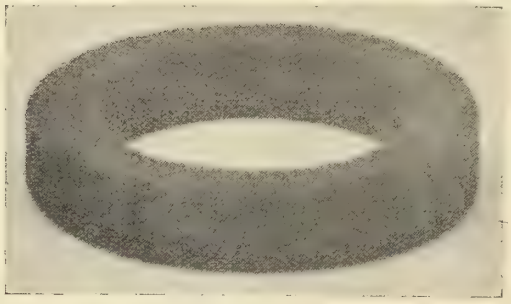
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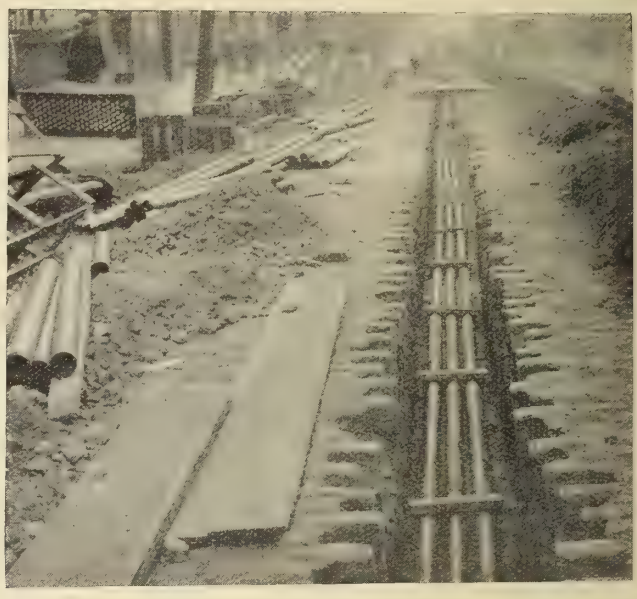
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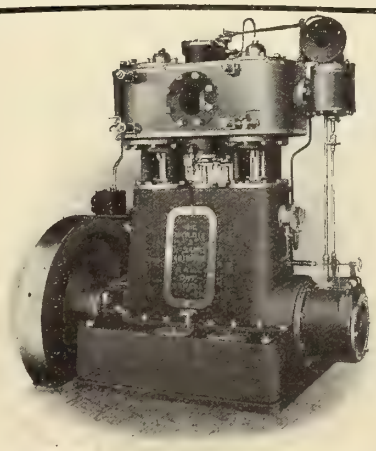
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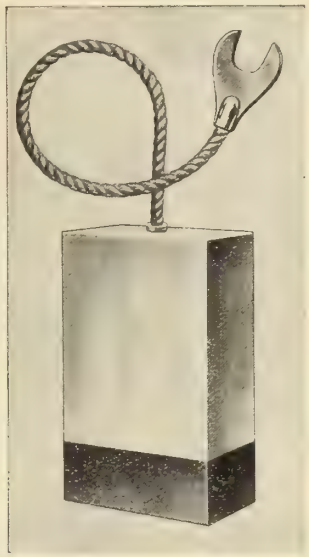
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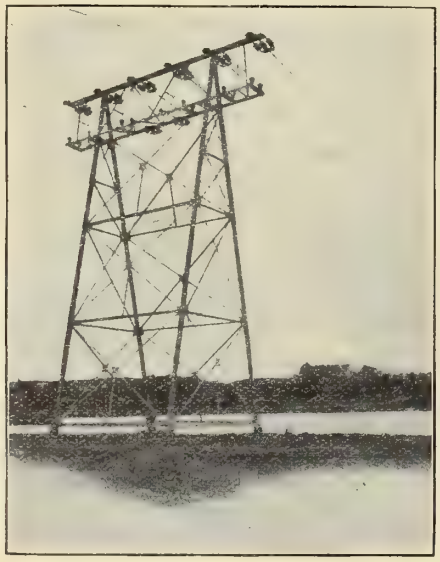
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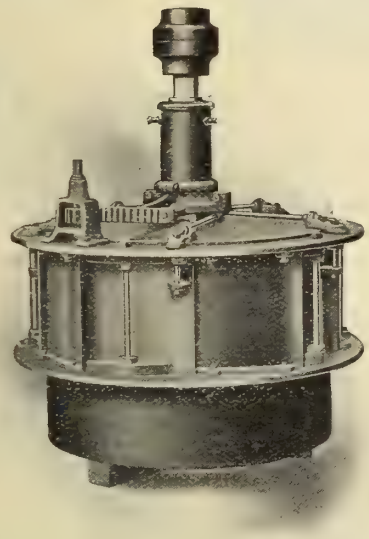
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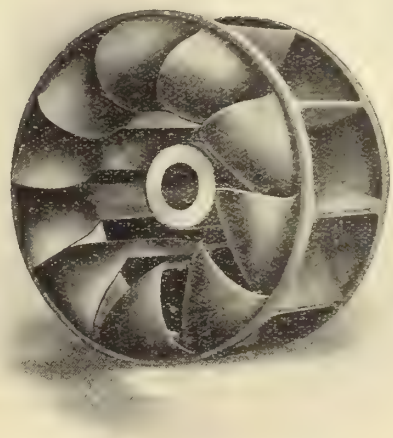


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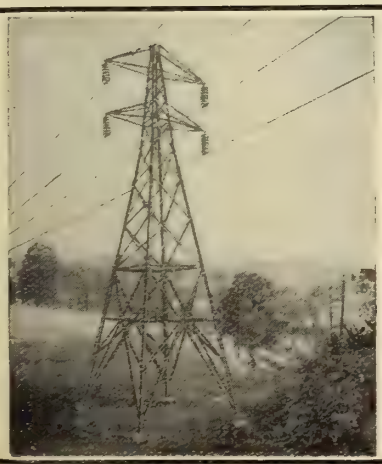
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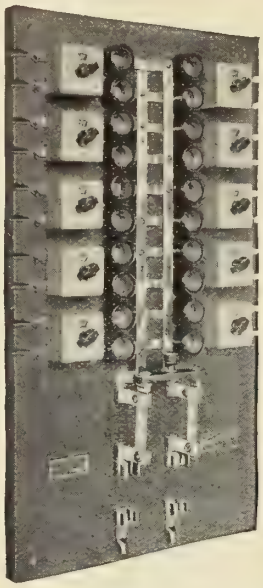
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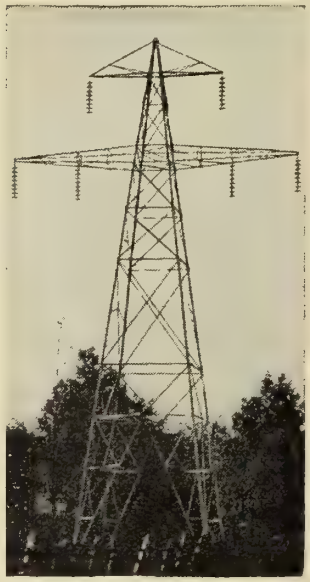
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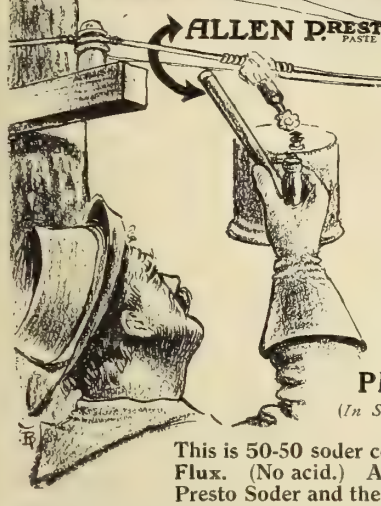
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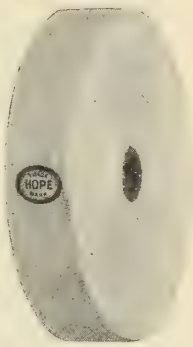
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300 Read Bldg. Montreal

Specialists in

Transmission Lines, Underground Conduit Systems, Power Plants, Etc.

Dietrich LIMITED



HOPE

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for

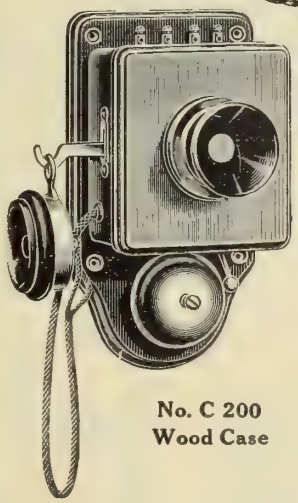
Electrical Work

Write for Samples and Prices

Hope Webbing Company

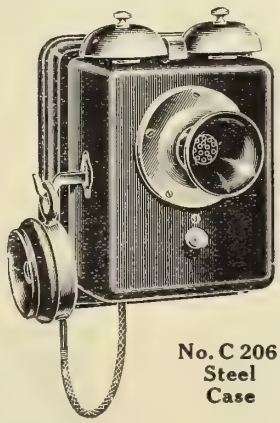
Providence, R.I.

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No. C 200 Wood Case

Cheap Phones with Induction Coils C Battery Ringing



No. C 206 Steel Case

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ALBERTA. — General Supplies, Ltd., 122 Eleventh Ave. W., Calgary.

QUEBEC.—Stocks kept by: Dawson & Co., Ltd., Montreal. Mechanics Supply Co., St. Paul, Que.

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"Electrical, Photometrical and Physical Tests and Inspections".
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BRADSTREET'S
Offices Throughout the Civilized World.
Executive Office:
Nos. 346 and 348 Broadway, New York City, U. S. A.

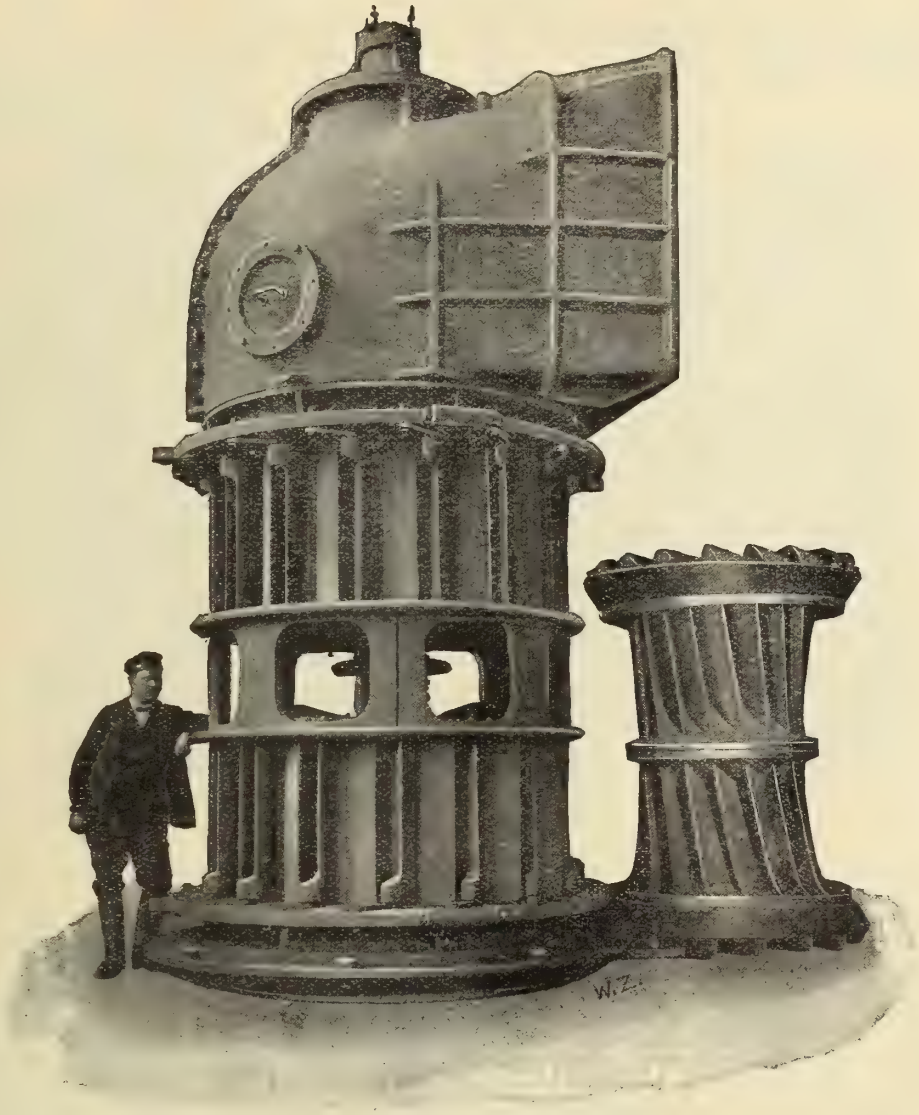
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LONG EXPERIENCE IN PATENT LITIGATION
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WATER TURBINES



TWIN VERTICAL TURBINES AS BEING SUPPLIED BY US TO

THE HYDRO ELECTRIC POWER COMMISSION OF ONTARIO

Boving & Co. of Canada Ltd.

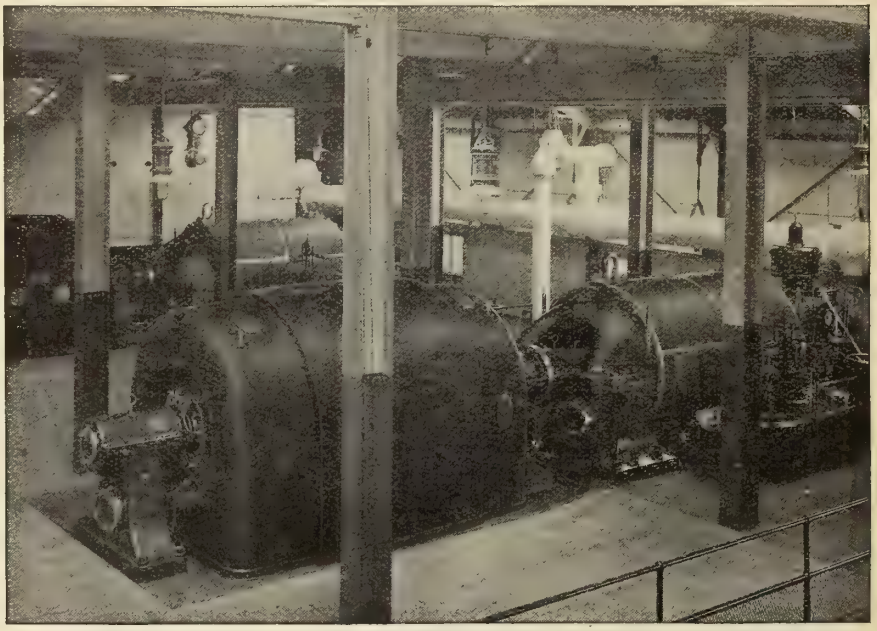
Head Office; 164 Bay Street, Toronto

Works, Lindsay, Ont.

94 Grafton Ave., Moose Jaw **804 London Bldg., Vancouver**

Mexico City Wellington Cairo London, Eng. Tokyo Johannesburg Rio de Janiero

Westinghouse Steam Turbines



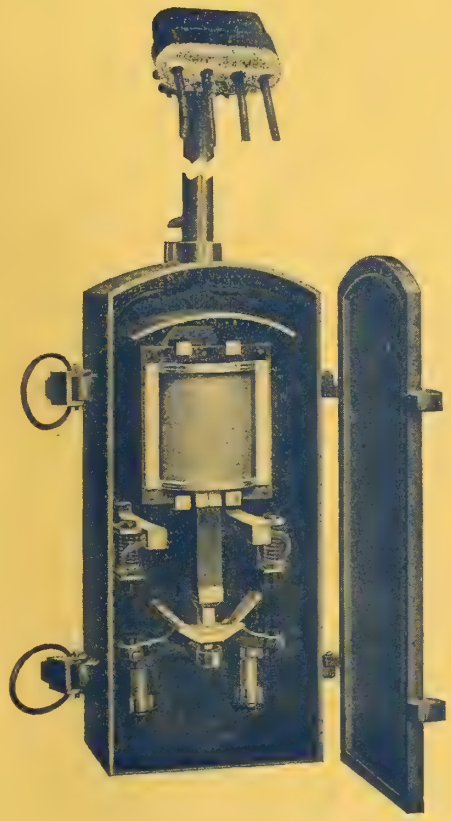
One Westinghouse 4,000 Kva. and One 3,500 Kva. Turbo-Generator in a Light and Power Central Station

They Carry The Load

WHEN a Westinghouse Steam Turbine is installed where other engines or turbines are already in service, you will find that the Westinghouse Turbine will accomplish a marked fuel economy on the same station load.—You simply have to run the Westinghouse Turbine all the time, and shut down something else.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

Toronto	Montreal	Ottawa	Halifax	Winnipeg	Calgary	Vancouver
Traders Band Bldg.	52 Victoria Sq.	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave., E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.



It is good enough for

The Hydro Electric Commission,

IS IT GOOD ENOUGH FOR YOU?

Type 17 H.E.P.—SOLENOID SWITCH

This is the type of Solenoid Switch which has been recommended and adopted by the Hydro Electric Commission who are continuing to send in orders. It is in use today in a great number of towns and cities throughout the provinces of Eastern and Western Canada.

This Switch is no experiment. The fact that it has been adopted by the Hydro Electric is proof of its success.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

Essential for Modern Street-Lighting Methods

LET US SEND FULLER PARTICULARS

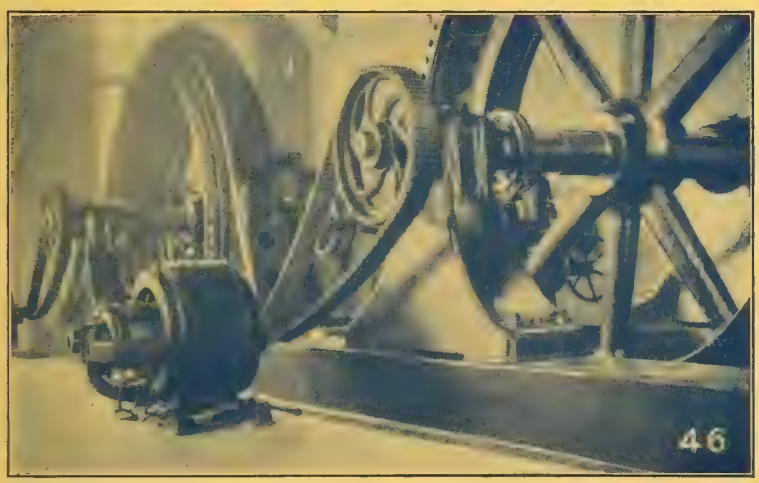
The Electrical Maintenance & Repairs Co., Limited

Adelaide 902-903
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Manager, Beach 1723
Superintendent, Beach 1930

162 Adelaide St. W., TORONTO

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EFFICIENCY RELIABILITY DURABILITY COMPACTNESS



Two Renold Silent Chains operating Exciters of 500 K.W. Generators in Canadian Municipal Power House

Appreciation of the advantages of **Renold** Driving Chains is not limited to the Industrial World. This is best evidenced by the fact that for Municipal and Government work of all kinds the Renold Chains are a standard form of Power Transmission.

Write for Illustrated Catalogue

JONES & GLASSCO, Engineers, (Reg'd.) Sole Canadian Agents **MONTREAL**

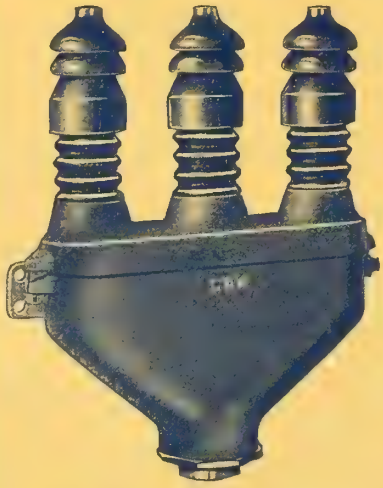
Branch Office: TORONTO

We stock Chain and Repairs

We can keep you running
while we make your repairs

Fred. Thomson Co., Limited

326-328-330 Craig Street West
Montreal



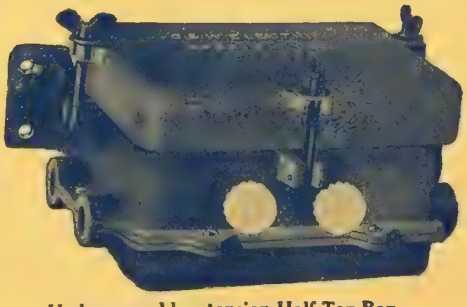
Reduce the Time of Service Interruptions

G&W ELECTRIC SPECIALTIES

on your lines through the use of some of these devices. Any pole or manhole can be made a switching and testing point at small cost by the adoption of G & W Distribution Devices. You need not experiment. Each device will do the work intended for it. They are doing this work on some of the largest systems in the country. When you install

G & W Distribution Specialties

you are safeguarding your system against long interruptions of service. Our large Catalog explains in detail how this is accomplished. We originated the first successful outside Pot Head. We make them in three types—detachable, non-detachable and combination—all voltages.

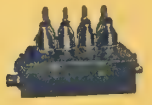


Underground low-tension Half-Tap Box
Cable submerged in compound

G & W Electric Specialty Company

6306-10 Blackstone Ave.
CHICAGO, U. S. A.

Send for Complete Catalog



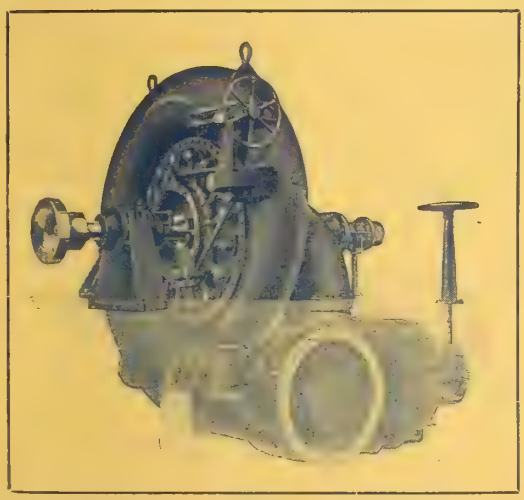


20

Vol. XXII - No. 24 Toronto, December 15, 1913

Electrical News

Generation, Transmission and Application of Electricity



90% EFFICIENCY

From SMITH HYDRAULIC TURBINES

Recent tests at Holyoke, Mass. on Standard Smith Turbines have again proven their superiority over any turbine now manufactured.

These tests showing efficiencies from **89% to over 90%.**

We design and build turbines for heads from 5 feet to 650 feet. Engraving represents a turbine of 900 H.P., 250 R.P.M., 110 feet head.

Send for Bulletin N

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Branch Offices: 176 Federal St., BOSTON, MASS.
614 American Trust Bldg., CHICAGO

THE IDEAL GIFT

The first real electric cooking set of its kind at a moderate price.



The Uni-Set

The C.G.E. Uni-Set is a compact practical table cooking outfit, including chafing dish, samovar, coffee pot, stove and nursery outfit. List price complete $25. For the moderate purse, the Uni-Set stove with chafing dish or any other single device is the start. The other Uni-Set devices here shown may be purchased separately as required. The C.G.E. Uni-Set will be one of the most popular gifts of the Season. Send your orders early.

CANADIAN GENERAL ELECTRIC CO.,

LIMITED

HEAD OFFICE - TORONTO

Montreal Halifax Ottawa Cobalt Porcupine Fort William Winnipeg Regina
Saskatoon Calgary Edmonton Nelson Victoria Vancouver Prince Rupert

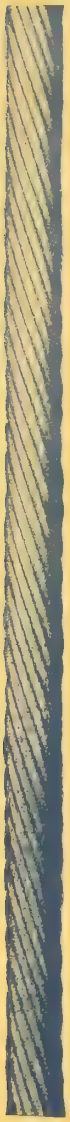
Alphabetical Index to Advertisers, Page 8





PHILLIPS

Electrical
Wires and Cables





Bare and Insulated Copper Wires and Cables.

Bare and Insulated Electric Wire and Cables for Aerial and Underground Use.

Railway Feeder and Trolley Wire.

Weatherproof Magnet and Rubber Covered Wires and Cables.

Incandescent and Flexible Cords.

Telephone, Telegraph, Lighting, Power and Street Railway Wires, Cables and Equipment.

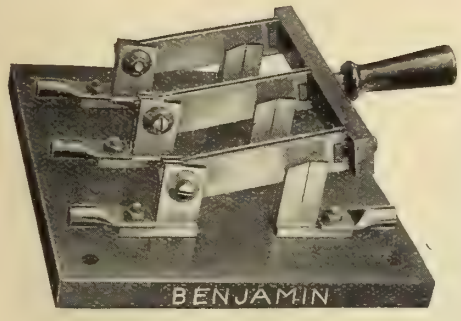




Eugene F. Phillips Electrical Works, Limited

MONTREAL - - CANADA

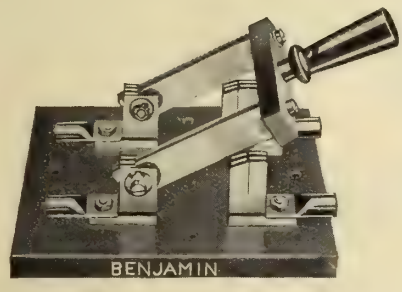
Branches: HALIFAX TORONTO WINNIPEG VANCOUVER



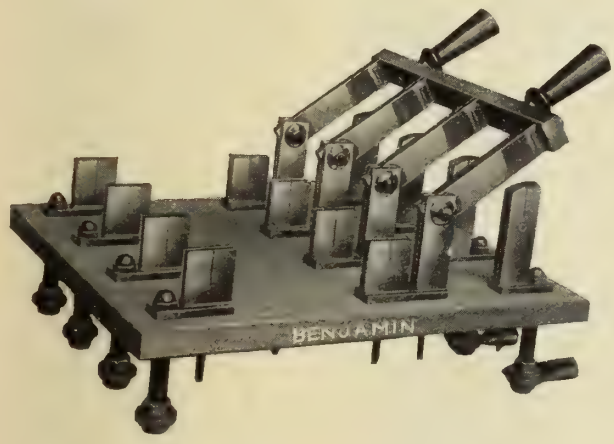
BENJAMIN

"ALL COPPER"

KNIFE SWITCHES



Type "A"
and
Type "C"



Material
Design
Workmanship
Strong and Rugged
Smooth Operation
Overload Reserve
Large Contacts
Large Radiation Surface

Write for Bulletin "22S"

Benjamin Electric Mfg. Co.
of Canada, Limited
11-17 Charlotte St., TORONTO, CANADA

Ferranti Meters

Service Efficiency 100 per cent.

No matter how heavy or how light the load—Ferranti meters can always be depended on to register the current consumption accurately and consistently.

Illustration shows our Improved Type "C" Meter, Single or Polyphase; top or bottom connections; clock or cyclometer dials.



Guaranteed for Three Years

against all defects of mechanical or electrical nature.

Our meters are assembled and thoroughly tested at our Toronto or Winnipeg warehouses where a large stock is always on hand.

Get our prices and try us on a rush order.

Send a postal for complete descriptive catalogue.

Ferranti Transformers

Oil Immersed Pole Type

The most efficient and economically installed transformer on the Canadian market. Realizing the extreme necessity for permanent reliability, the design has been made very substantial to meet the requirements of every condition; all parts are easily accessible.



Single or Three Phase Current

Of these types the Ferranti Three Phase is the most efficient and is supplied to give any secondary voltage required — one transformer of this type does the work of three of the single phase type.

Let us quote you our prices and then judge for yourself.

NOTE OUR NEW WINNIPEG ADDRESS.

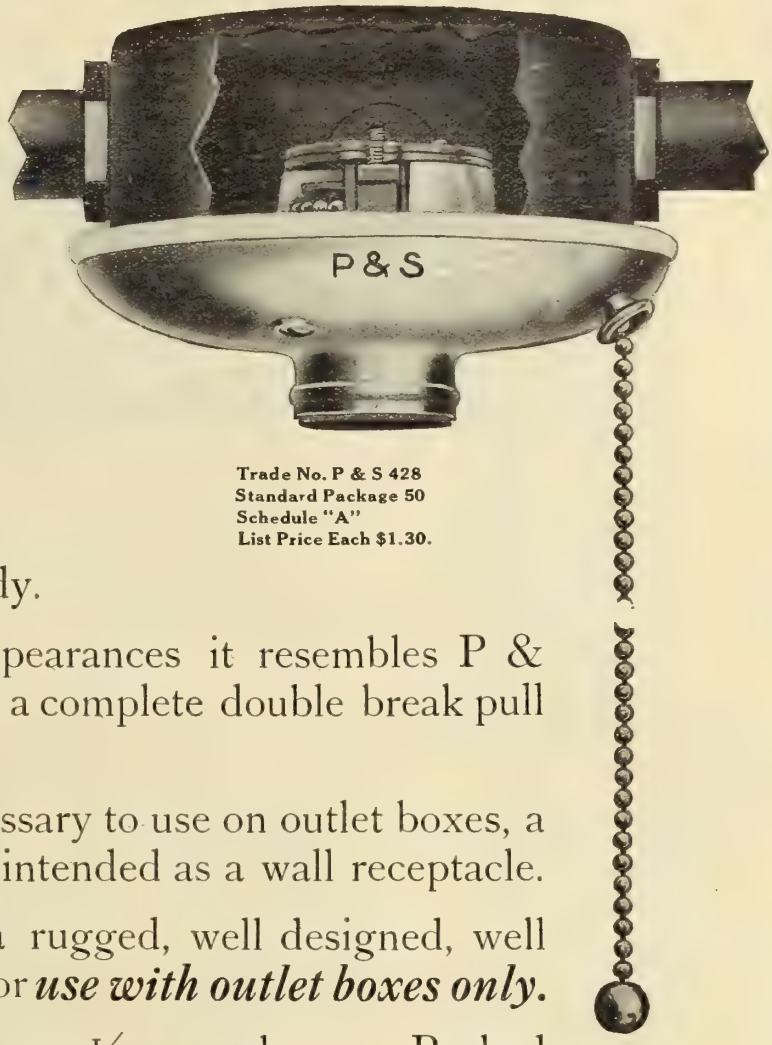
The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building, Cor. Notre Dame & Langside, WINNIPEG

Something Different and Better

It would seem that the 58 different receptacles we make for outlet boxes would cover the field, but here is a new one recently evolved by our engineers.



Trade No. P & S 428
Standard Package 50
Schedule "A"
List Price Each $1.30.

And it's a dandy.

In outward appearances it resembles P & S 10, but it contains a complete double break pull mechanism.

No longer necessary to use on outlet boxes, a pull receptacle really intended as a wall receptacle.

P&S 428 is a rugged, well designed, well built pull receptacle for ***use with outlet boxes only.***

It may be used on 3 ¼" or 4" boxes. Packed one in a paper carton, each carton containing the screws to fasten to outlet box.

Each receptacle is supplied with 6 inches of chain to which is attached 10 feet of black cord complete with ball.

Your Jobber is now ready to fill your order from stock.

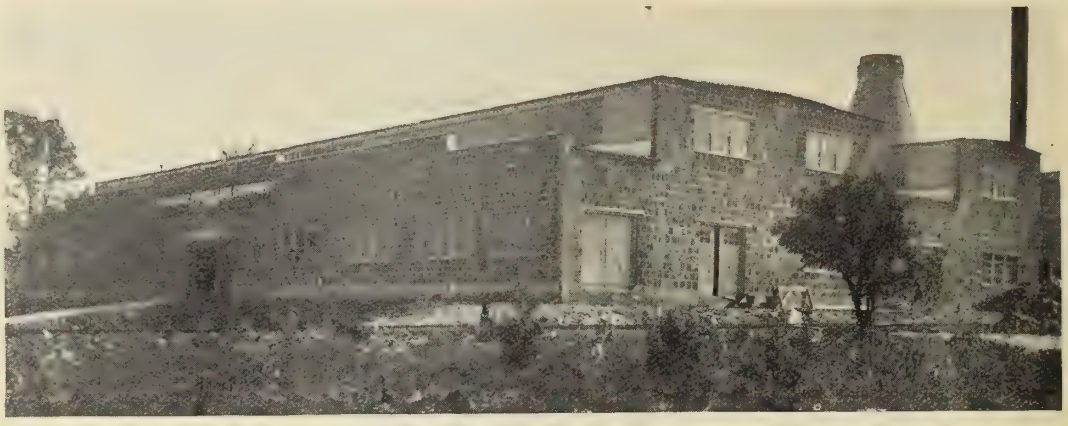
Pass & Seymour, Inc.

Main Office and Works, **Solvay, New York, U.S.A.**

San Francisco — Rialto Building

The Canadian Porcelain Company, Limited

HAMILTON, - ONTARIO



Cut shows new plant recently completed and now in operation.

We wish to announce our readiness to tender on your insulator requirements.

Our plant is modern in every respect embodying the best European and American practice in arrangement and methods.

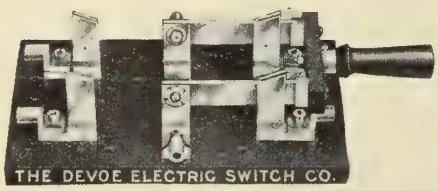
Our plant is in charge of experienced insulator specialists.

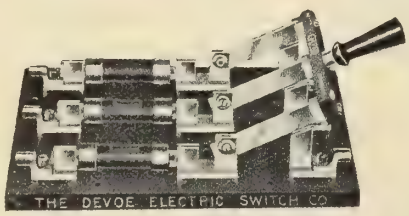
The Devoe Electric Switch Company

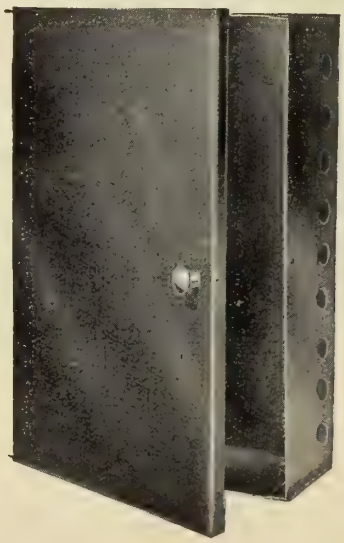
MANUFACTURERS

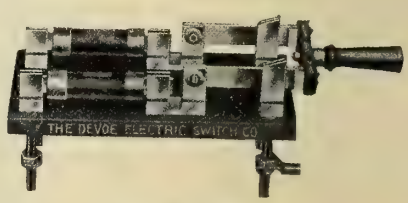
We design and manufacture SWITCHBOARDS, PANELBOARDS, CABINETS, SWITCHES and IRON BOXES of every description.

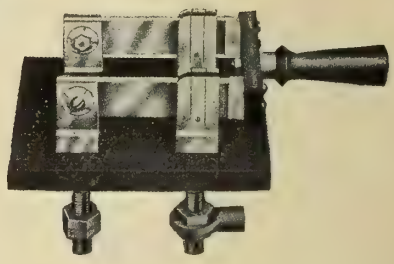
Quotations promptly made upon request when drawing or sufficient data are submitted.











Write for Switch Catalogue No. 6 and Box Bulletin No. 2.

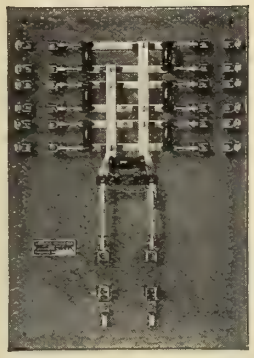
Send us your Specifications.

Office and Factory: No. 157 Craig St. West, Montreal

Frank G. Scofield, Ontario Sales Representative, Lumsden Building, Toronto, Ontario

Panel Boards and Cabinets

That Embody Advanced Structural Principles
Material and Workmanship, the Best



Type A Panel

OUR line of Panel Boards includes four distinct types, each made in single and double branch forms, with mains carrying lugs only, fuses, fuseless knife switch, and fused knife switch for 2 to 2 and 3 to 2 wire systems. Three to 2 wire Panel Boards are made in convertible form as well as the standard construction.

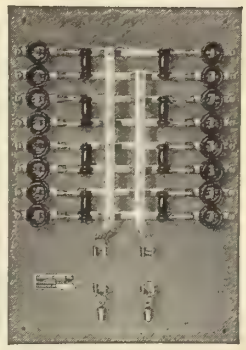
Type "A" Panels [125 and 250 volts]—Branches arranged for enclosed fuses and with or without knife switches.

Type "D" Panels [125 volts]—Branches arranged for plug fuses and with or without knife switches.

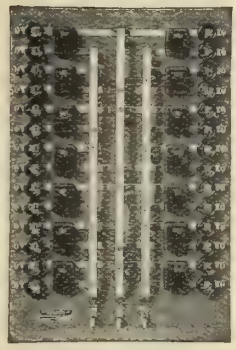
Type "F" Panels [125 and 250 volts]—Branches arranged for enclosed fuses and snap switches.

Type "H" Panels [125 volts]—Branches arranged for plug fuses and with snap switches.

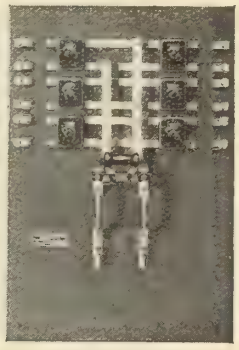
Our designs in Cabinets embrace fifteen types—all steel, steel and wood combined and wood with slate lining, either for flush or surface mounting and with side or back gutters, also without gutter.



Type D Panel



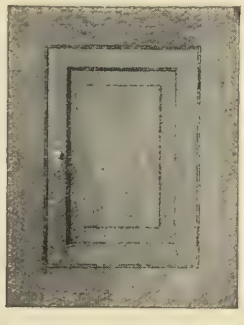
Type H Panel



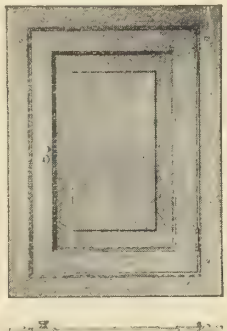
Type F Panel



Type M Cabinet



Type DFP Cabinet



Type ESQ Cabinet



Type CL Cabinet

If your dealer does not stock them, write us.
"Panels and Cabinets," Bulletin No. 1 sent free upon request.

Crouse-Hinds Co. of Canada, Ltd.

Main Office and Works:

Toronto, Ontario, Canada

Kindly send me Bulletin No. 101

Name.....

City.....

Prov.....

21013

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Fire Dept. Headquarters, Toronto. A GALVADUCT Bldg.

LORICATED

"GALVADUCT"

The most perfect interior construction conduit on the market.
Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

From Halifax to Vancouver you will find Galvaduct and Loricated Conduits carrying the electric wiring in the largest buildings, the finest homes and in many industrial plants.

Always specify "Galvaduct" or "Loricated."

Conduits Company Limited.

Toronto - Montreal

For You Who Wanted High Class Equipment





"Use Is The Test"
KELLOGG

What is Christmas to you?

A time of happiness, fun for the youngsters, house gathering, presents, helping others? Probably all of these, but the last generally gives more satisfaction than all else.

To some the giving of telephone service at so much per twelve month may be no visible philanthropy but the satisfaction of giving the best service—a service that is of far reaching value to the whole town—is real.

Our part is to make equipment that is the greatest factor in the producing and continuing of such a service.

KELLOGG SWITCHBOARD & SUPPLY COMPANY, CHICAGO, ILL.

CANADIAN SALES OFFICE: REGINA—DEERING ELECTRIC LIMITED

GREENFIELDUCT

GREENFIELDUCT *The Pipe* GREENFIELDUCT

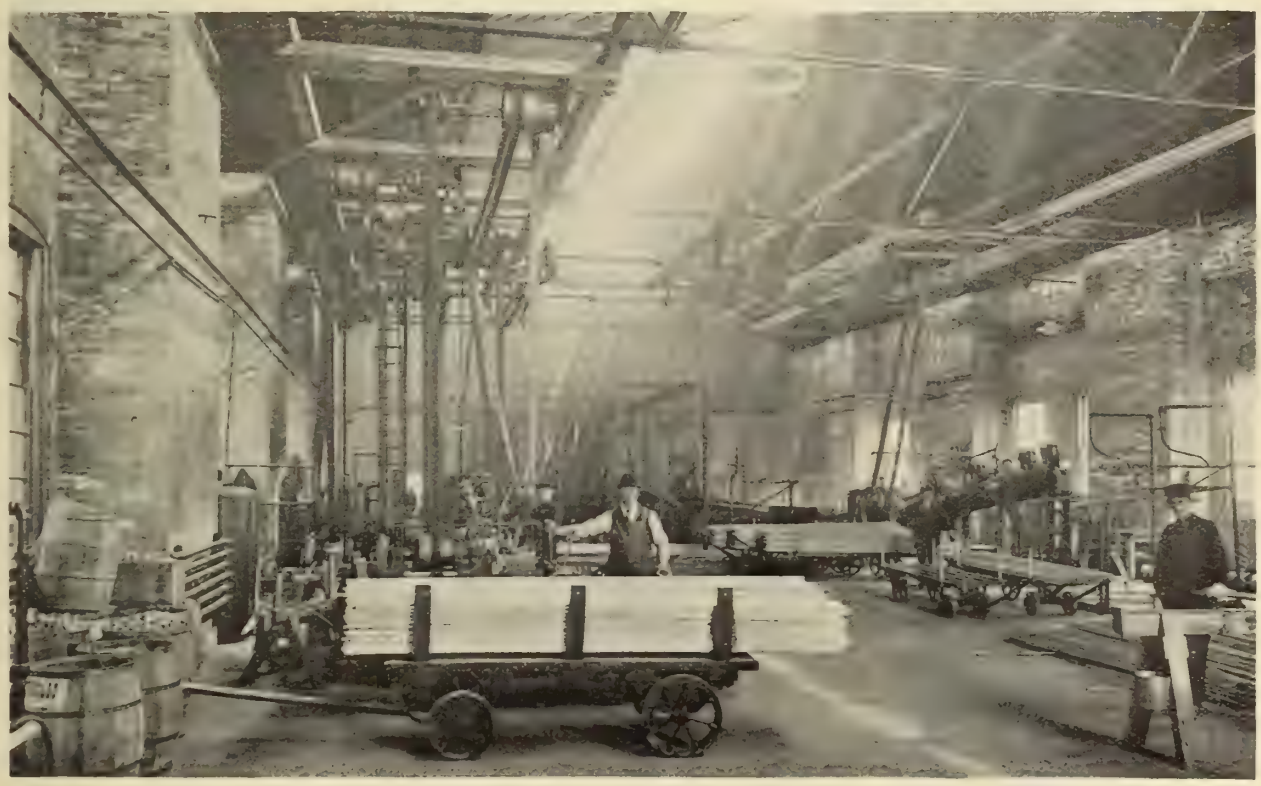
GREENFIELDUCT *of Quality*

WILL NOT RUST



Hot Galvanized *Inside* and *Out*—Clean Cut Threads Perfect Joints.

Stands higher acid tests than any conduit.



Approved by National Board of Fire Underwriters

MANUFACTURED BY

GREENFIELD CONDUIT CO., LIMITED

SALES AGENTS

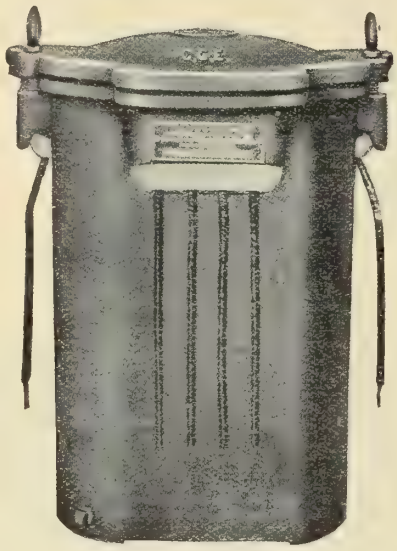
ELECTRICAL FITTINGS CO., LIMITED

GREENFIELDUCT **331-333 W. King St., TORONTO, CAN.** GREENFIELDUCT

Pole Type Transfomers

— ARE —

SAFE, DURABLE, EFFICIENT





"DURABLE" means long life and long life means a saving in interest and depreciation charges and fewer interruptions in service.

Why are C.G.E. Transformers Durable?

Because: First, the design is such that a maximum of both core and winding surface is exposed directly to the oil, resulting in even heat distribution;

Second, the insulating materials are the best selections after many years of experience;

Third, the parts are mechanically held together in a most substantial manner.

In efficiency are second to none.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert.

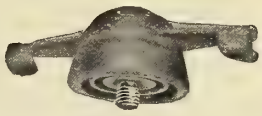
The Use of Overhead Line Material

Will Reduce Your Operating Expenses

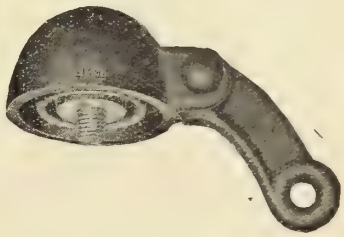


Form H Double Curve Suspension.

600 Volt



Form H Straight Line Suspension.



Form H Single Curve Suspension.



Form H Single Curve Suspension.

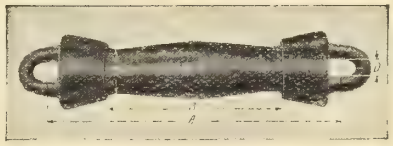
1200 Volt



Form H Double Curve Suspension.



Form L-4 Section Insulator.



Wood Strain Insulator.



Giant Strain.



Adjustable Crossing.



Form K Trolley Frog.

All iron and steel parts are rendered dust-proof by our process of Sherardizing.
We will be glad to furnish information regarding any method of overhead construction.

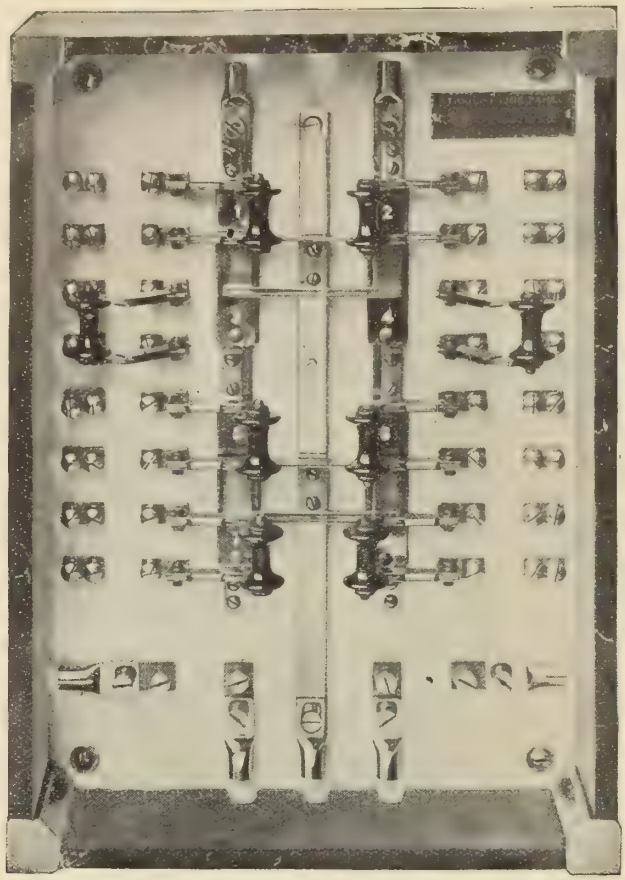
Write our nearest office for particulars.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: TORONTO

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert



KRANTZ

Safety and efficiency characterizes all designs of

KRANTZ
Switch Boards and Panel Boards

They are used in many of the largest institutions, office and Government buildings throughout Canada and the United States.

See that your specifications call for "Krantz." They are recognized by leading engineers as a standard and are passed by the Underwriters' Association.

GET OUR QUOTATIONS

The Canadian Krantz Elec. Mfg. Co., Ltd.

249 Victoria Street

TORONTO ONTARIO

MEC

Make Your Store Attractive

MEC

by putting in a stock of

Universal Heating Material

Each device is beautifully finished in polished nickel and will make a nice display on your shelves or in your windows.

Every article guaranteed.

Our large stock enables us to make prompt shipment of "last minute" Christmas orders.

Mainer Electric Company, Limited

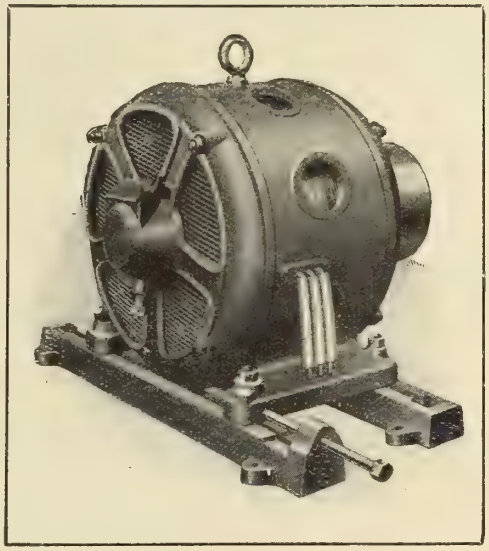
Winnipeg, Man. ***Edmonton, Alta.***

MEC

NEW GOODS PROMPT SHIPMENTS RIGHT PRICES

MEC

WE CARRY IN STOCK



Squirrel Cage Motors up to 45 H. P.

We can supply Electrical Machinery from 1/8 to 6,000 H. P.

CANADIAN BRITISH ENGINEERING COMPANY, LIMITED

324 Smith Street, WINNIPEG

Pressed Steel Dash Headlights

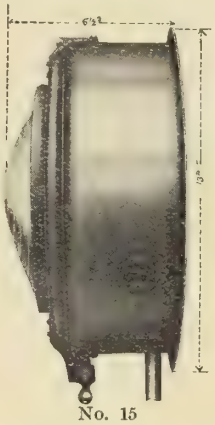


No. 14

Practically only two parts —door and back reflector case; reflector and back case in one piece.

Reflector of white porcelain enamel.

Can furnish either semaphore or plain lens.



No. 15

Made in type to be set in dash, or to be screwed outside of dash.

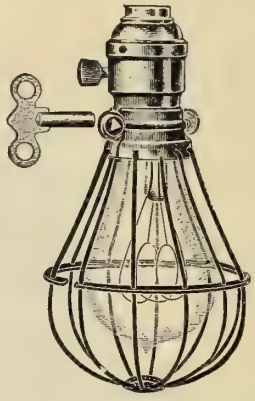
Weight is but ten pounds, as compared with 25 of cast iron.

Can furnish ruby lens to be used as rear markers.

The Trolley Supply Company
Canton, Ohio, U. S. A.

LOXON
LAMP GUARD
THE KEY TO SAFETY

The Logical Guard To Use and Sell



It should not take much argument to convince any dealer, jobber or central station that Loxon is the satisfactory guard to sell ; nor a lamp consumer that it's the best to use.

It's double protective feature Absolute Safety against both Breakage and Theft, give it a selling value you can't get away from. Its reasonable cost to users, a good profit for dealers—make it the right guard to push.

Fall and Winter is the time when Loxons save big money.

Make no mistake—

Get the genuine Loxon—Made only by

McGill Mfg. Co. 5 Oak St., Valparaiso, Ind.

The John Inglis Company, Limited

Engineers and Boilermakers



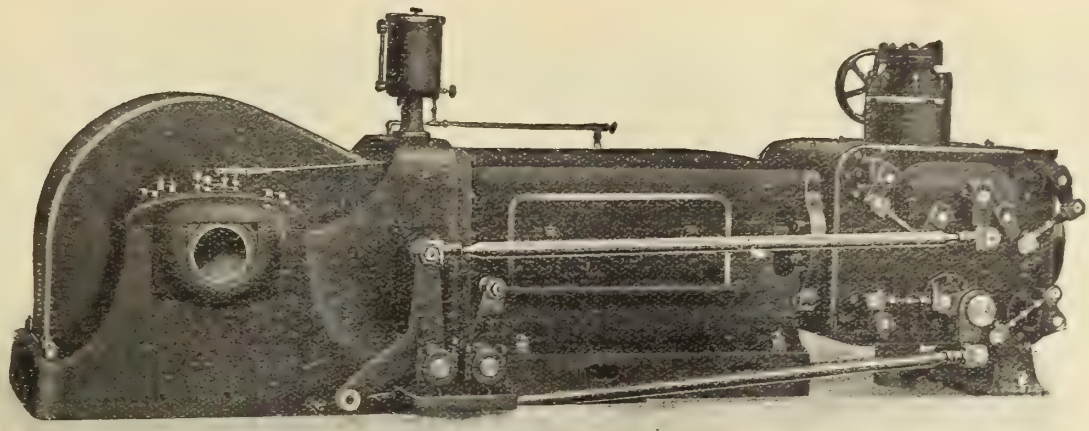
Shipments of large tanks leaving our shops

"Inglis" Boilers, Engines, Pumping Machinery and Tanks, are all over Canada. They are the Standard.

Write us for specifications, prices, &c. It will pay you.

14 Strachan Avenue, TORONTO, CANADA

A. Angstrom—Montreal Representative, Room 509 Canadian Express Building



You can direct-connect this Corliss engine to your generator, for it will run at high speed—225 revolutions per minute.
It will give you a horse power on as little steam as any Corliss—you know what that means.
These features are not startling individually, but are remarkable in combination.

ROBB CORLISS ENGINES

have those features which give high speed, short stroke, multi-ported valves and a valve gear that does not depend on a releasing mechanism for quick opening and closing. There are no springs, dash pots, latches, cams, or disengaging parts. Yet the positive valve gear uses the steam almost perfectly, permits adjusting each event independently, reduces loss by having small clearances, — in short well-known Corliss economy.

A new Bulletin describing this engine is just out.
Ask for Robb Bulletin No. 202.

International Engineering Works, Limited

Manufacturers of

ROBB

Water Tube Boilers
Scotch Boilers
Vertical Engines
Horizontal Boilers

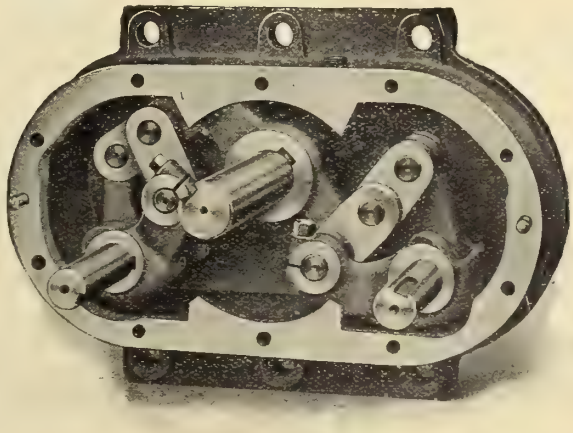
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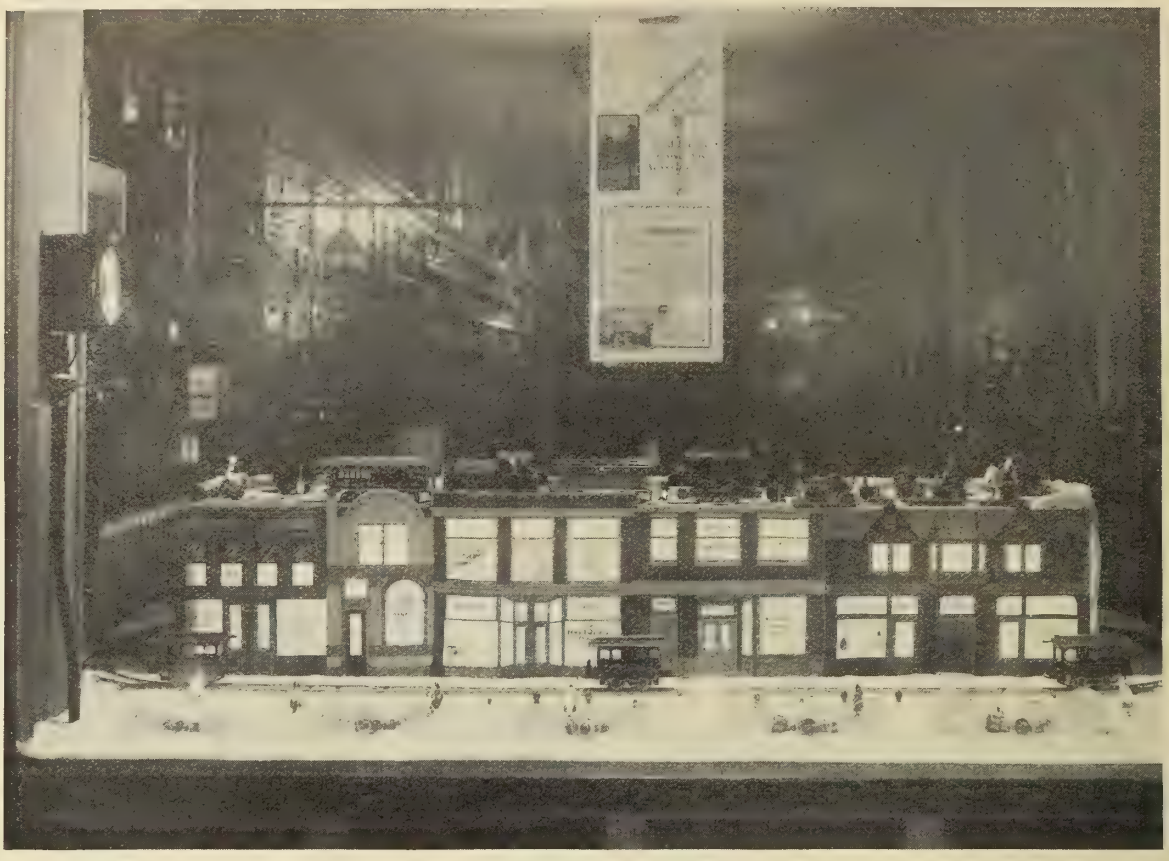
South Framingham, Mass.

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Transportation Bldg., Montreal	R. W. Robb, Mgr.
Traders Bank Bldg., Toronto	E. F. Bradley, Mgr.
641 York Street, Edmonton	W. F. Porter, Mgr.
Grain Exchange Bldg., Calgary	J. F. Porter, Mgr.
816 Burrard St., Vancouver	Geo. M. Taylor, Mgr.
321 Edmonton St., Winnipeg.	J. F. Tracy, Mgr.

39—58





Ask for Placard Set No. 9.

Mazda Street Miniature Window Display

to Show People Where to Get

Sunbeam Mazda Lamps

You can set up this display in a few minutes and you will be surprised at the attention it will draw. It's an easy and inexpensive way to let people know that they need go no farther to get Sunbeam Mazda Lamps.

We will furnish you with a booklet entitled "Your Silent Salesman" showing 12 different window trims with full directions.

Send today and make use of these trims while they are new.

Canadian Sunbeam Lamp Co.

Limited

Main Office and Factory: TORONTO

BRANCH WAREHOUSES:

MONTREAL **WINNIPEG** **CALGARY** **VANCOUVER**

A SILCOR TUMBLE

Beats The Balls Buffer, Sand Blast

And all other devices for polishing

THE HIGHEST AND CHEAPEST LUSTRE AND IN EVERY TINY CORNER

TENDER WITH THE MOST DELICATE BUT CUTS THE HARDEST STEEL BRASS, NICKEL, CAST IRON, GERMAN SILVER, STEEL—ANY METAL

Small Plants—Five dollars' worth of "SILCOR" and an improvised barrel will save most all that hand labor.
Large Plants—Dispense with hand labor and roll both tiny and huge pieces in "SILCOR."
Holding a piece to a buffer is as illogical as turning the buffer by hand. Let the Power roll it in "SILCOR." "SILCOR" will find every spot.
It costs so little to polish by tumbling with "SILCOR" that no piece ought to leave your plant unpolished.
Send 10c and parcel postage for sample pound and shake some of your pieces in a tin can. Then send for a barrel load.

Corundum Products Company

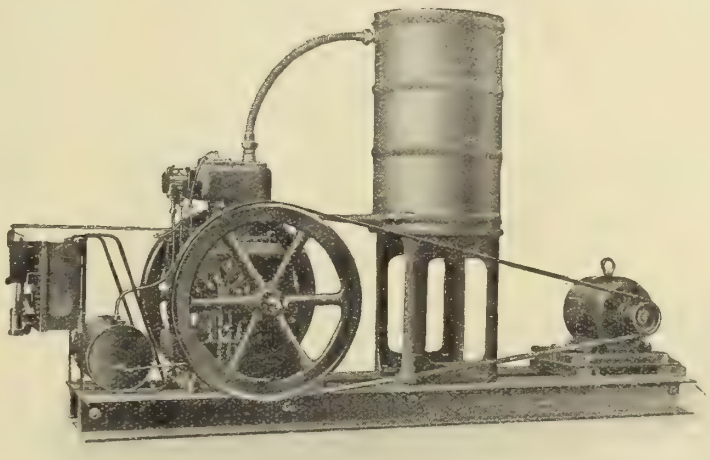
Spokane, Washington, U. S. A.

The LISTER-BRUSTON

AUTOMATIC ELECTRIC LIGHTING PLANT

Are you interested in the lighting of

Country Houses
Hotels
Summer Homes
Churches
Factories
Small Towns
Villages?



This is the easiest and cheapest plant to install and wins you the confidence of your customer.

Agents Wanted

Specifications and tenders for complete installations submitted on application.

THIS PLANT generates electricity automatically and does away with the necessity of large expensive storage batteries. With the exception of keeping it clean, lubricating and filling the gasoline supply tank, no attention is required. In addition to these advantages the first cost is low, space required small and no foundations are necessary. It is delivered practically ready for connecting up to the house wiring, and can consequently be used within a few hours of being unpacked.

R. A. LISTER & COMPANY, LIMITED

Winnipeg **58-60 Stewart St., TORONTO** **St. John, N. B.**

You Still Have Time
to Order
Tungstolier Seasonable Suggestions



For Your

Xmas Trade



(Get Bulletin Covering Novelties)

The Tungstolier Company of Canada Limited

Head Office and Sample Rooms, 4th Floor Canadian General Electric Bldg., Simcoe and King Sts., Toronto

Monarch Electric Co., Ltd.

St. Lambert, P. Q.

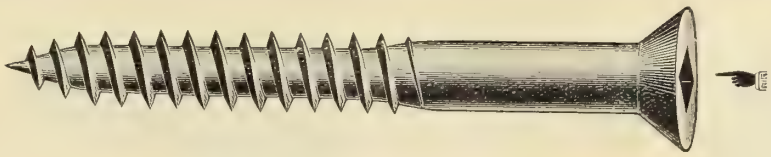
Phone Main 3988 Montreal Exchange **District Montreal**

A few of the Monarch Canadian Made Specialties manufactured in this, our own building, are:

Sockets—Rosettes—Attachment Plugs
Lamp Guards—Knife Switches



Oil Circuit Breakers
Switchboard Accessories
Switchboards
Transformers
for Instruments



SEE THAT SQUARE HOLE

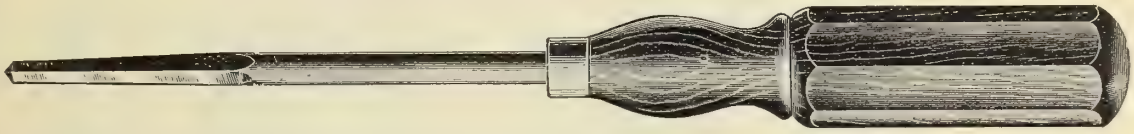
PAT. FEB. 2, 1909

ROBERTSON SOCKET HEAD WOOD SCREWS

This new socket screw can effect a wonderful saving of time and material especially in electrical wire and fixture erection, etc.

They are used by simply placing the screw on the driver and then you may reach out at arms length and drive it in with one hand. For overhead work or work between joists or under flooring it is invaluable.

Samples and prices on request



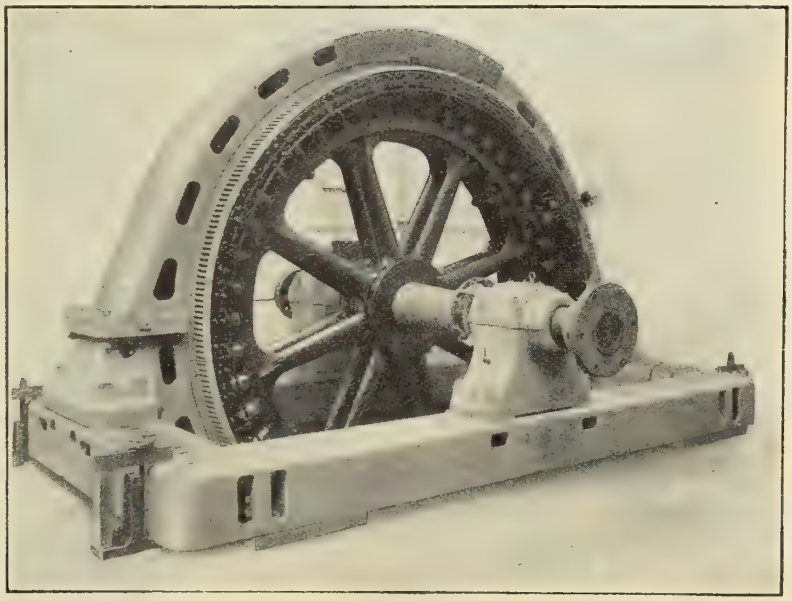
The P. L. Robertson Manufacturing Co., Ltd.

Milton — Ontario

CANADIAN VICKERS LIMITED

Patent Automatic Reversing Drive for Planing Machines

Complete Equipments for the electrical lighting and driving of machine shops, factories, etc.



Turbo Generators

Motors of all types

Motor Generators

Rotary Convertors

3000 K. W., 6600-volt, 164 R.P.M. 3-Phase Generator for the City of Winnipeg. Five Generators have been supplied

Head Office for Canada: Lewis Building, Montreal
Mr. J. F. I. Thomas (Representative)

Works:
River Don Works, Sheffield, England

Packard

unexcelled for Accuracy, Reliability and Permanency of Calibration







Large Stocks Carried at

St. Catherines and Winnipeg; St. John Railway Co., St. John, N. B.; General Supplies, Limited, Calgary, Alta.; Rudel-Belnap Machinery Co., Canadian Express Bldg., Montreal, P. Q.

Get our quotations

The Packard Electric Company, Limited

Factory at ST. CATHARINES, ONT.

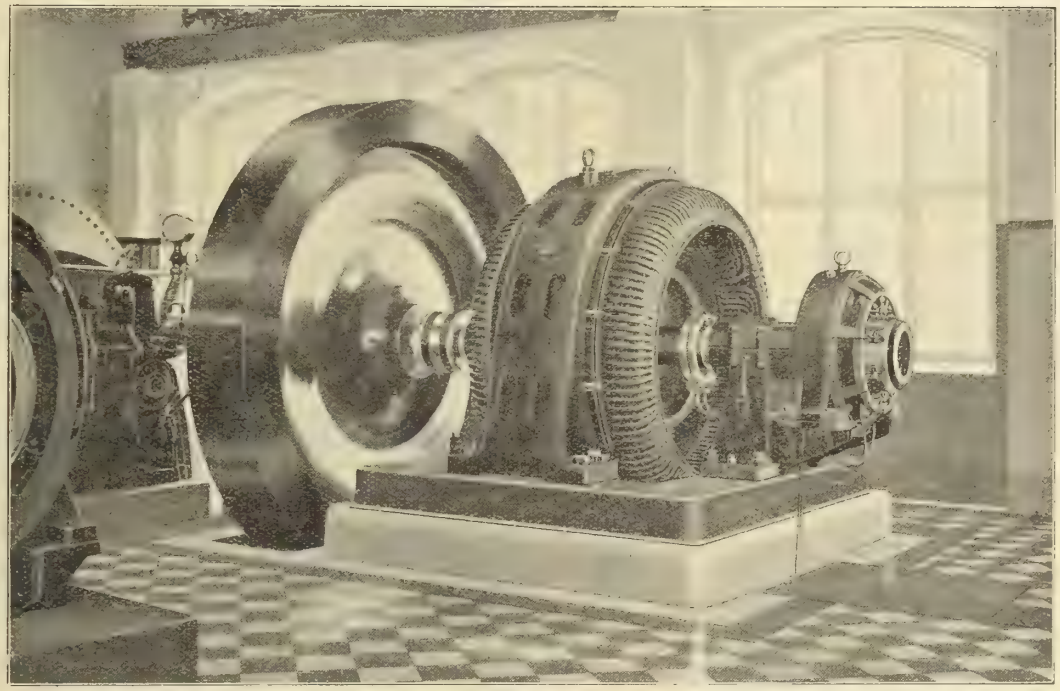
General Sales Office
Traders Bank Bldg., TORONTO

N. W. Office and Warerooms
WINNIPEG

Swedish Electrical Machinery

Noted for

Efficiency and Workmanship



860 K.V. A. 3 phase, 60 cycle, 400 R. P. M., 11500 volt water wheel driven Generator with direct connected exciter.

We solicit your specifications for Electrical Equipment

BURNHAM ENGINEERING COMPANY

LIMITED

Canadian Dealers for

The Amalgamated Electric Company of Sweden

Head Office:
Traders Bank Building,
TORONTO

Montreal Representatives:
Rudel Belnap Machinery Co., Ltd.
Canadian Express Bldg.

Electrical Books
FOR SALE

"Tesla High Frequency Coil," by Haller & Cunningham. Published in 1910 by D. Van Nostrand & Company. Price $1.25.

'Elementary Telegraphy," by Pendry. Published in 1910 by Whittaker & Company. Price $1.00.

'Practical Testing of Electric Machines," by Oulton & Wilson. Published in 1909 by Whittaker & Company. Price 75c.

"Wireless Telegraphy Construction for Amateurs," by Morgan. Published in 1910 by D. Van Nostrand & Company. Price $1.50.

"Direct and Alternating Current Testing," by Bedell. Published in 1909 by D. Van Nostrand & Company. Price $2.00.

"A Laboratory Manual of Alternating Currents" by John H. Morecroft, E.E. Published in 1912 by Renouf Publishing Company. Price $2.00.

'Modern Electrical Construction," by Henry C. Horstmann and Victor H. Tousley. Published in 1911 by Frederick J. Drake & Co. Price $1.00.

"Electricians' Operating and Testing Manual," by Henry C. Horstmann and Victor H. Tousley. Published in 1910 by Frederick J. Drake & Company. Price $1.50.

"Telephony," by Samuel G. McMeen and Kempster B. Miller. Published in 1912 by the American School of Correspondence. Price $3.00.

"Elevators, Hydraulic & Electric," by Calvin F. Swingle. Published in 1910 by Frederick J. Drake & Company. Price $1.00.

"Practical Mathematics for the Engineer and Electrician," by Elmer E. Burns and Joseph G. Branch. Published in 1912 by the Joseph G. Branch Publishing Company. Price $1.00.

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"Wireless Telegraphy and Telephony Simply Explained," by Alfred P. Morgan. Published in 1913 by the Norman W. Henley Publishing Company. Price $1.00.

"Experimental Wireless Stations," by Philip E. Edelman. Published in 1912 by Philip E. Edelman. Price $2.00.

"Electric Wiring & Lighting," by Charles E. Knox, E.E. Published in 1913 by the American School of Correspondence. Price $1.50.

"Electric Arcs," by Clement D. Child, Ph.D. Published in 1913 by D. Van Nostrand Company. Price $2.00.

"Conversations in Electricity," by Branch. Published in 1908 by the Branch Publishing Company. Price $2.00.

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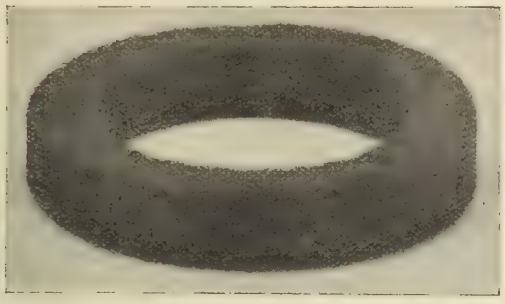
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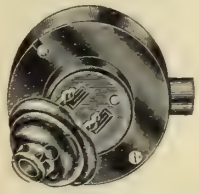
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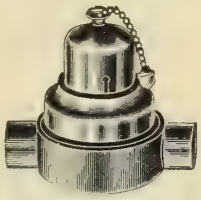


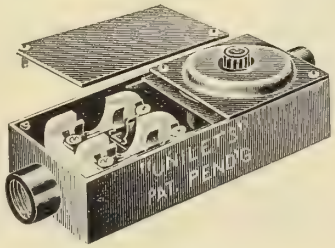
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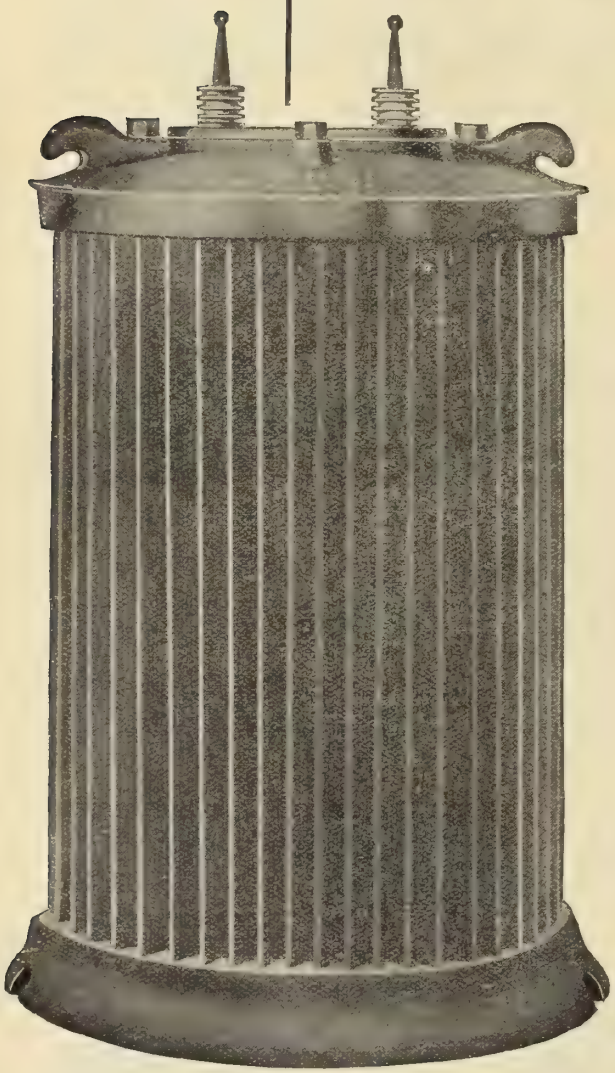
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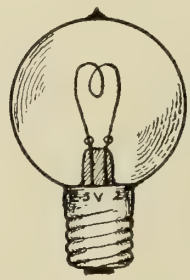
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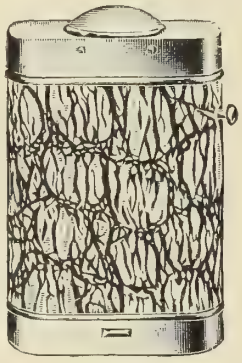
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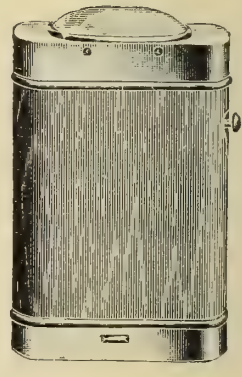
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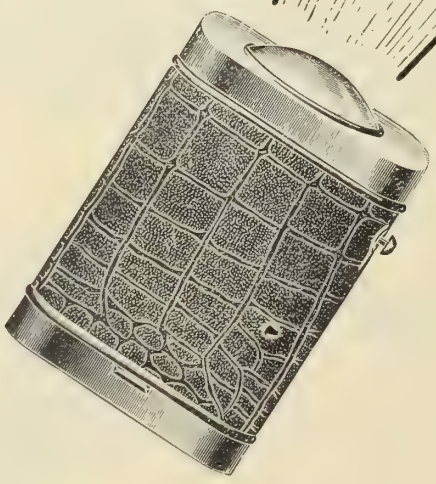
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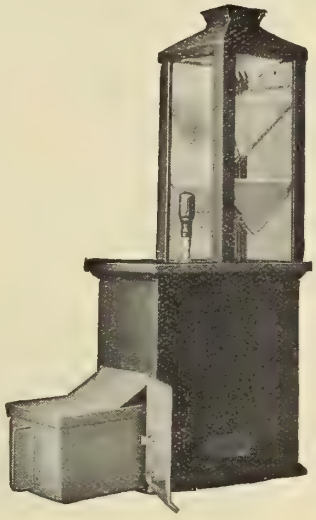
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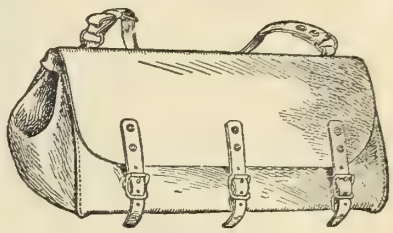
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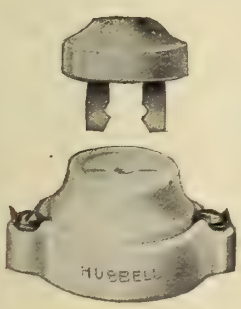
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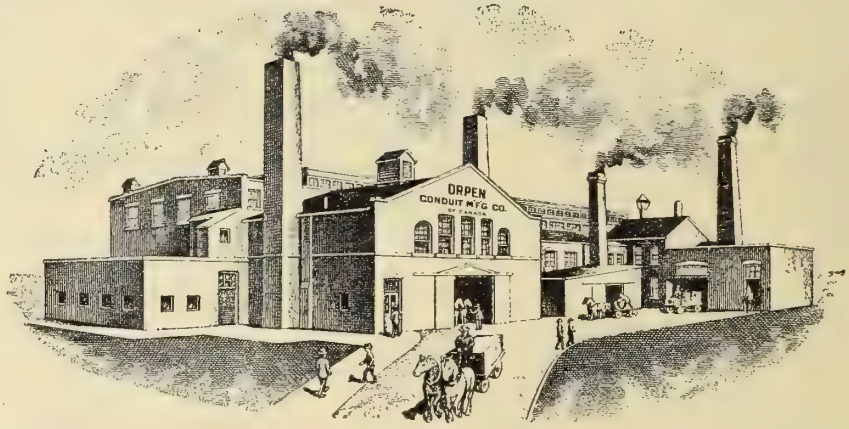
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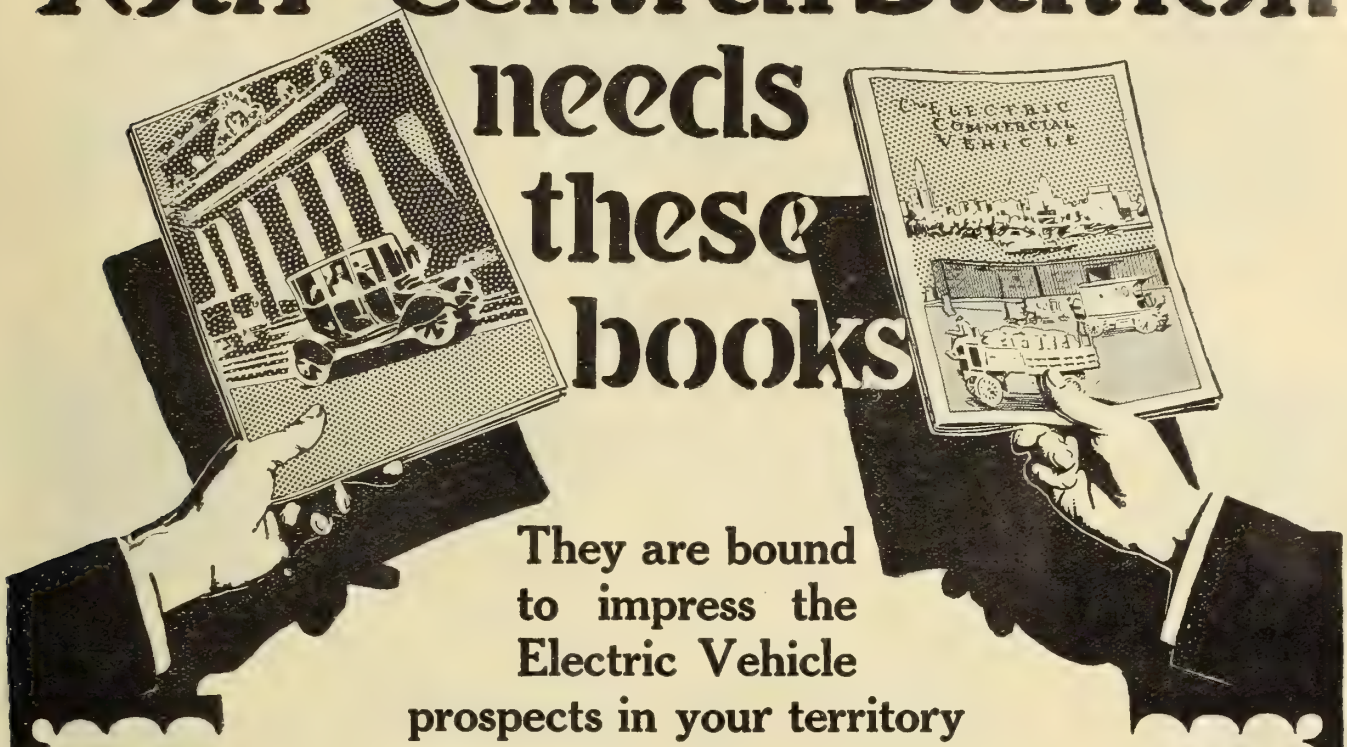
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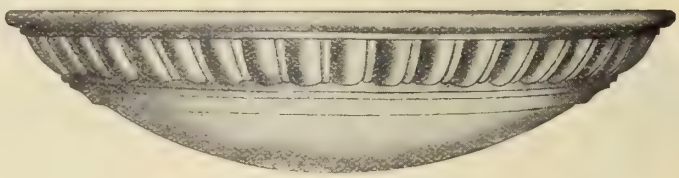
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No. 6020 Moonstone Semi-Indirect Unit



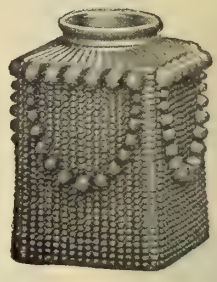
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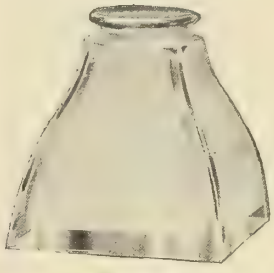


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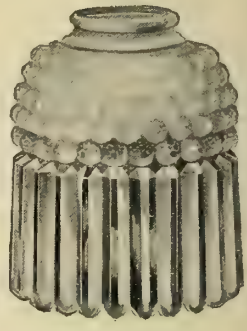
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No 1002 Electric



No. 6024 Semi-Indirect Unit

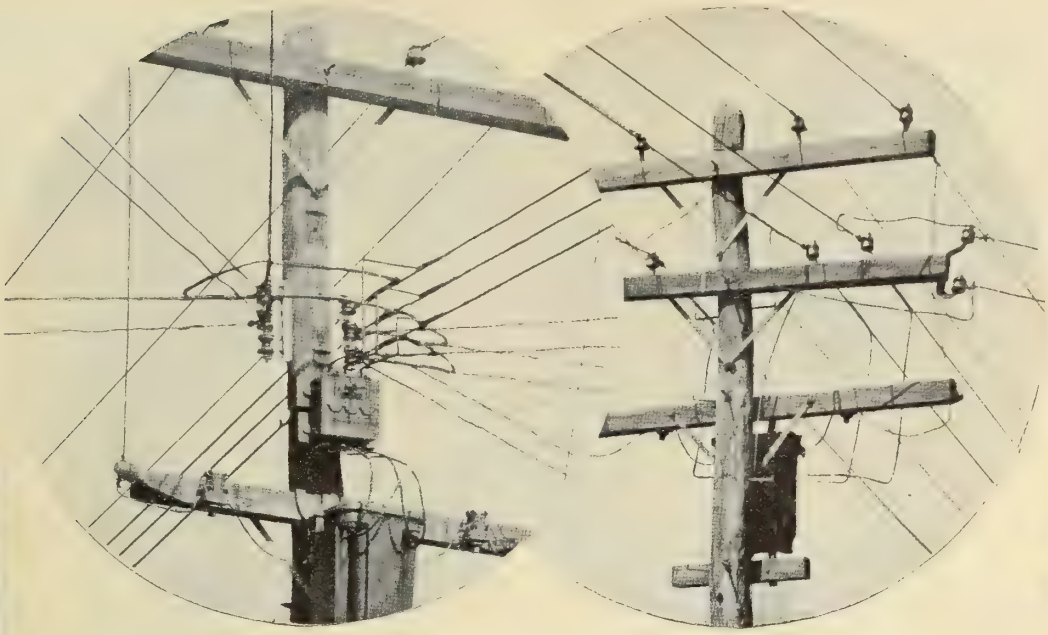


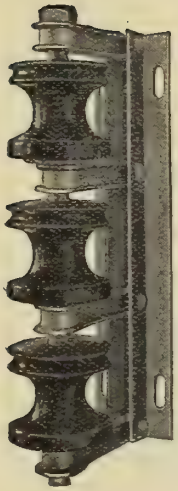
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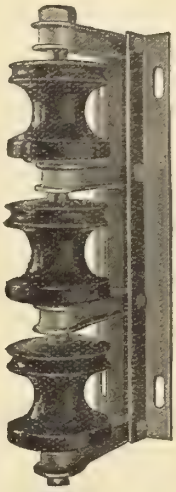
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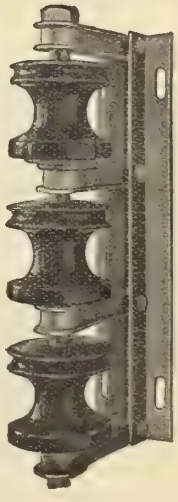












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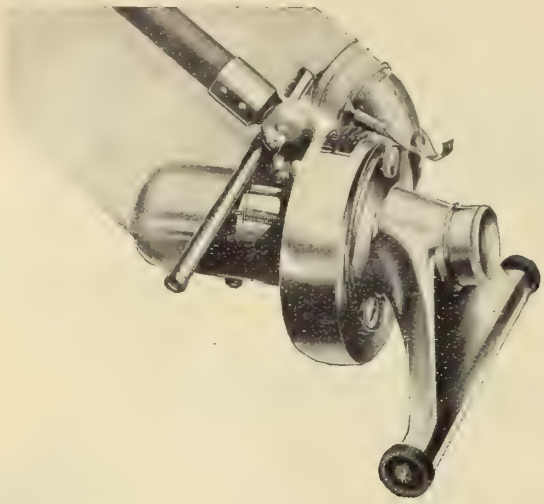
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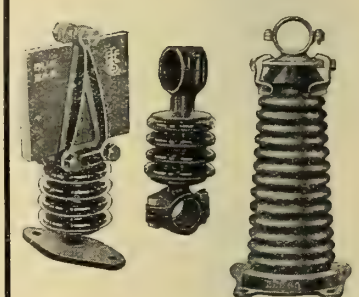
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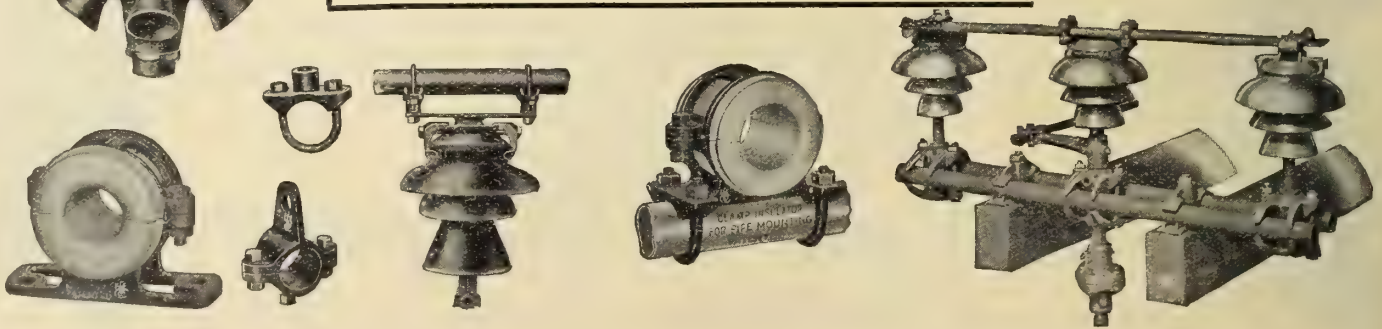
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Wishing You A Merry Christmas

Nothing will add so much to the Christmas season's enjoyment as the feeling that Canada has passed the "peak" of the financial depression of the past few months. It is possibly too early to affirm this definitely but the opinions generally expressed by authorities in finance are almost invariably hopeful and in some cases most optimistic. We now appear to be standing on a solid foundation; the money strain is distinctly easing, building permits are showing good increases, banks are experiencing comparatively little difficulty in handling the crops, the more recent bond issues by our cities have met with good success and finally, the weak places seem to have all been exposed in the stock market, and there are encouraging signs that the savings of the past year are now being gradually brought into investment. This latter is a very encouraging sign and perhaps indicates, more than anything else can, the returning confidence of the public.

Prospects in the electrical trade are good. A large number of municipalities have been delayed in their extension work and may naturally be expected, with easier money, to branch out again in the spring. In the smaller lines in which the jobber or contractor is more directly interested the outlook is unusually encouraging, for the "small" man is probably better supplied with ready money than for many years, due to good wages and the atmosphere of thrift which has recently prevailed. The Electrical News believes Canadians never had better cause to give themselves up to the enjoyment of a Merry Christmas and this, we sincerely hope, one and all will be enabled to do.

Industrials Paying Bonuses

Mr. Frederic Nicholls, vice-president and general manager of the Canadian General Electric Company is quoted, in an interview, as denying the rumor that any material reduction in the working staff at Peterboro is contemplated. Mr. Nicholls states that, although the number of employees in Peterboro now approximates 5,000, there are so many departments in the Peterboro factories and the orders have been coming in so satisfactorily, he believes continued employment can be assured, in one department or another, to all. Mr. Nicholls attributes this desirable state of affairs—all the more remarkable in this time of semi-depression in many of our industries—to the splendid reputation of the products of his company, their diverse character, and to the fact of the tremendous expansion of Canada with the resultant expenditures for railway, public works, power and lighting supplies.

The Canadian General Electric Company is a splendid example of the Canadian industry which bases its operations on sound management and a faith in Canada's future. With such a foundation there does not seem to be any need to fear temporary storms like that of the past year. Most of our troubles—domestic, individual and otherwise—are creatures of a too vivid imagination. We see calamities impending that have no existence in fact. A little more faith in ourselves as a nation and a little more confidence in Canada's future is a good lesson for us all to take to heart at the present moment.

The directors of the C. G. E. Company have since given tangible proof of their own confidence by the declaration of a one per cent. bonus along with the regular dividend

Ancient vs. Modern Electric Installations

From a western town comes the complaint that electric wiring is many times more costly than it was a few years ago and a committee will investigate and report. It may be this municipality are being held up by electrical contractors who take this method of balancing their account against the inactivity in real estate; but it is far more probable they will only find the cases they compare are not parallel and that the requirements of electric installations of to-day as compared with a few years ago are so totally different as to make comparison of even similar costs a sheer waste of time.

Electric wiring of a few years ago consisted in the crudest workmanship imaginable, with equally crude and unsafe systems. The old open work with knob and cleat was not safe even when first installed, and it rapidly deteriorated. It was so simple to install wires that every member of the house from the shool-boy up quickly became an electrician. The results have been highly unsatisfactory and often fatal, but always dangerous to such an extent that the public and contractor alike have clamoured for more stringent rules with greater safety to life and property. The Fire Underwriters' Association have also been keenly interested and have latterly framed a set of rules which, from their experience, are necessary to guard the interests of all.

Very possibly the public do not distinguish between electric wires wrongly installed and electric wires properly installed, which is tantamount to saying they do not distinguish between imminent danger and perfect safety. There is nothing more deadly than the electric current, but, properly controlled, it is the personification of utility and safety. This is the point, doubtless, the western town has missed but it is the all important one in every electric installation.

The modern methods of installing electric wires makes it a practical impossibility that harm should come to either life or property. Surely this is worth the extra cost. And even at that, the cost of installation as compared with its everyday usefulness is far less than with any other kind of equipment we purchase to assist us in our daily work or in

enjoying our spare moments. The expense incurred in a proper electric installation should more correctly be looked upon as an investment—it is permanent and it yields splendid dividends.

We do not wish to be understood as defending unnecessary or extortionate charges for this or any other kind of work but in as far as only necessary expenses are incurred there is no doubt that money spent on the proper installation of an electric system of any kind is well spent.

Is It Good Business?

The practice of financing the installation of new equipments by means of tender cheques, however satisfactory it may appear on the surface for the municipality concerned, is, we believe, impossible to defend from a business point of view. As this scheme appears to be an evolution of the fruitful western brain, it may be necessary to explain its operation, as it is not yet practised to any extent in Eastern Canada.

The town of Smithville, say, requires electrical equipment valued at $50,000 and calls for tenders. Along with the tenders, a guarantee of good faith to the amount of five per cent. is required, amounting in this case to $2,500 each. If twenty firms tender, the total amount received by the municipality in marked cheques is thus $50,000. If Smithville follows the practise of "cashing in" they now have sufficient funds to finance the whole proposition. It may appear at first sight that the relief is only temporary, but when we consider that, in some cases, months elapse before any decision is reached regarding the tenders, and sometimes more months before the unsuccessful tenderers can get their money back, it will be seen that a considerable financial advantage is gained by the municipality.

However, quite aside from the legal or moral aspect of the case, it looks to us as if the game were not worth the candle. In the first place, it has been suggested that a municipality is lowering its dignity in resorting to such a practice. In the second place, it is pretty certain that the manufacturers take all these little things into consideration in submitting their tenders, with the result that the advantages to the municipality are more apparent than real.

We incline to the opinion that a municipality stands to gain every time by giving the manufacturer or tenderer as little trouble as possible. To this end we believe the guarantee accompanying tenders may safely be done away with or certainly reduced to a minimum. The delay in returning cheques is also bad business and will be remembered by the tenderer the next time this municipality is in the market for equipment. A guarantee for fulfilment of contract is, of course, another matter, though in this respect, too, the bounds of wisdom seem to be often overstepped.

Rights of Company Recognized

An interesting controversy has been going on for some time in Truro, N.S., between the Chambers Electric Light Company and the town of Truro. The Chambers Company were originally given a monopoly of the private and municipal lighting of Truro, but recently the town took the matter to the legislature and through the claim that the franchise conditions were not being properly observed they obtained the right from the legislature to instal equipment to supply light for the streets and public buildings. They were not allowed, however, to compete in private house lighting. The legislature also granted to the town the right to use the Chambers poles for their distribution wires.

Following this order it appears that the company decided they would rather have their wires under the municipality's wires and, so, lowered them, compelling the municipality to go to the top of the pole. The municipality objected and applied for an injunction to stop the company from lowering their wires. The company on their part made a counter claim alleging that a recent by-law of the town, requiring the use of certain wire by the company, was illegal. Judge Ritchie has finally handed down a judgment which is more or less a compromise. The judgment states that the lowering of the wires seems unreasonable and must cease, but the company's contention that the town's by-law regarding the use of certain wire was illegal, is upheld. It is understood there is more trouble to follow and it looks as if the town might pay pretty dearly for their privilege of lighting the streets before the matter is settled.

Developments in Toronto's Purchase Problem

It is now definitely settled that the Toronto street railway "purchase" question will not be put to a vote on January 1. During the past few weeks the matter has absorbed the attention of a number of the more prominent business men with the result that many new phases have developed which will require much time for full consideration. One of the new developments is a counter proposition brought forward by the Board of Harbor Commissioners whose plan calls for the entrance of municipal radials from east and west along the water front with a subway running north and south to let north end radials in. It is claimed that by this plan the city outskirts would become more or less independent of the Toronto Railway Company, which could thus be left to live out its natural life of another eight years. The new plan is claimed to be not an alternative to buying out the Toronto Street Railway, but to buying out at the present named price, which the average business man appears to think excessive. Mr. Bion J. Arnold, commenting on the new scheme, is reported to have said that it would work in well with the mayor's scheme of purchase. If this is so, then, since each system would practically be independent of the other it begins to look as if the Harbor Commission's plan is a fair solution of the transportation of Toronto's suburban population without the expenditure of some $12,000,000 for "intangible" assets.

The Situation in Windsor

An interesting fight seems to be on between the Detroit Edison Company and the Hydro-electric Power Commission of Ontario in the Windsor district. The commission is running a high voltage line from St. Thomas west to Windsor to supply that town and the surrounding towns and villages as well as the municipalities along the transmission line with power and light. The Detroit Edison Company are said to have purchased a number of electric plants in this district including those in Walkerville, Essex, Amherstburg, Harrow, Leamington, Kingsville, etc., and to be making extensions preparatory to competing actively with anything the Ontario Commission may do. They claim, it is said, to be able to sell power much more cheaply than the Commission can at such a great distance from its source of supply. The Detroit Edison manufacture by steam in Detroit, but have a very large and modern plant under efficient management and are thus able to produce power at very moderate rates. One difficulty in the way of the competition is that the consent of the Canadian Government has not been given to the Detroit Edison Company to import power into Canada. The Detroit Edison Company claim that a conspiracy has been formed to prevent them from doing business in Ontario and point to an interference, with the arrest, of a number of their men a few days ago who were erecting poles in Walkerville. Following this incident the town were granted an injunction temporarily restraining the company from continuing the work but Mr. Justice Latchford has since dissolved the injunction.

In the General Interest

An order has just been issued by the Dominion Railway Board requiring the Toronto Power Company to move back one of their poles a couple of feet, at their own expense, in order that the city of Toronto may proceed with certain work at present under way. The order is worthy of notice as establishing a sort of precedent in such cases, though corporation counsel Geary stated that this was not the city's point of view and that there was no intention of a "general onslaught on the company." The order was issued on the grounds that the removal of the pole was necessary to allow improvements needed for the benefits of the municipality. The question was raised as to the jurisdiction of the Railway Board in such matters but Chairman Drayton pointed out that this was fully covered by the Railway Act. The order is also interesting in that it indicates both the power and the inclination of the Railway Board to let nothing stand in the way of improvements clearly shown to be in the interests of the general public.

Extensions to Filtration Plant

Tenders are received by the Mayor and Board of Control of the city of Toronto up to January 20 for a complete mechanical filtration plant, boilers, steam turbo-generators, and all appurtenances necessary to the completed plant.

The electrical equipment calls for a steam turbo-generator set of 1200 kw. capacity, 2200 volts, 1500 r.p.m., to operate condensing, and to be so constructed that it will run in parallel with the hydro-electric system. An exciter of the necessary capacity is to be direct connected to the turbo-generator shaft.

The necessary switchboard panels and instruments for the control of the generator, motors and lighting are also required.

Three pumps of a capacity of 36,000,000 gallons each per 24 hours, to be operated by three-phase, 2200 volt, 25-cycle, 720 r.p.m. motors will be required; also two rotary air-blowers to be motor driven. If these latter motors are designed for operation on less than 2200 volts, transformers will also be required. Boiler equipment to the extent of four boilers, internally fired, and having not less than 2200 square feet of heating surface each, will be needed; also wire, switches, brackets, lamps, etc., for lighting the entire plant.

Sherbrooke Railway & Power Company

Our last issue announced that the Sherbrooke Railway & Power Company have just acquired the assets and undertakings, which include the poles, wires, franchises and distributing system of the Burroughs' Falls Power Company, Limited, of Ayers' Cliff, Que. This adds another electric lighting system to the ones already owned and controlled by the company, which are as follows:—The Lennoxville Light & Power Company, Limited, which controls the business in Lennoxville and Huntingdon; the Eastern Townships Electric Company, Limited, which controls the business in Eustis, Waterville, Compton, North Hatley and Capelton; the Stanstead Electric Company, Limited, which controls the business of Beebe Plain, Hatley, Massawippi, Libbytown and Ways Mills; and the International Electric Company which controls the lighting business of Derby Line, Beebe, Que., and Derby Centre, Vermont, U.S.A. These vompanies have small water powers of their own. It has, however, been the policy of the company so as to facilitate giving the best service possible, to connect all these various electric light companies by one transmission line from the company's main development on the Magog river in the city of Sherbooke. The transmission line which is a 22,000 volt line, is 35 miles in length and taps en route the electric light companies owned and controlled by the company. As a result the company has become the controlling factor in the electric lighting and power business in the thickly populated district lying between the city of Sherbrooke and the United States boundary.

Dynamo Room Rules

The following list of rules is framed and hangs in a conspicuous place in a power house in one of our western towns. It contains some useful hints for the loafer. It is all too common to find the power house a sort of evening rendezvous with the engineer an unwilling host, afraid of giving offence to his patrons by hinting that he has work to attend to. Aside from wasted time, too, few people realize the necessity for absolute cleanliness in an electric plant or the difficulties in maintaining this condition.

1. Walk right in, spit on the floor or in the dynamos; the electrician likes it; tobacco chewers specially welcome.
2. Take Electrician's chair; he will always be pleased to sit on the floor.
3. The Electrician often has magazines, please help yourselves; if you do not like them just let him know what you do like, he will always be pleased to purchase them for you.
4. If the Electrician should be reading a magazine or book you think you would like, just take it, he will not mind.
5. Help yourself to cigarettes, tobacco, etc.; matches will be found in the cupboard.
6. Be sure and drop cigarette ashes in the dynamos; it increases the efficiency of the generators.
7. The cupboard is usually unlocked during night time; please have a good look at the contents of same; there are many interesting things and the Electrician will be delighted to explain any of them to you.
8. Ink and all writing materials will be found on the bottom shelf of the cupboard; please help yourself, the desk is entirely at your disposal.
9. Please remember the Dynamo Room was built for your benefit; be sure and make as much use as possible of it; eat your suppers there; chew tobacco and spit all over the place; the Electrician will be delighted to clear up after you.

Fire Alarm Apparatus in New C.P.R. Station

The most up-to-date private fire alarm system in Canada will be installed in the new C. P. R. station at Vancouver. The system will be on the lines of the standard Gamewell Municipal system installed in most cities and towns in this country.

At different points in the station a Type K closed fire alarm box will be located. This box consists of a breakwheel driven by a train of gears, and as each box has a different numbered wheel the exact location of the alarm will be indicated. This box is practically the same as a regular street box, but on account of being inside the building it has no outer case or lightning arrester. An alarm is sounded by breaking the glass and pulling the hook. The signal from any operated box will sound four 10 in. electro-mechanical gongs of regulation pattern. One 6 in. gong will also be installed.

The battery power will consist of forty Edison-BSCO. cells, and two panels will regulate the flow of current. One panel will have voltmeter and ammeter and switches, with rheostat to keep current at one-tenth ampere and test switches. The other panel has a relay which will give a disarrangement signal should the battery become disconnected or the circuit interrupted at any point. The test panels, batteries, gongs, and boxes will all be converted in series and current will flow at all times. Should the current become interrupted at any point a signal will be given.

This system has many advantages over the open circuit

systems installed in many buildings, the chief one being that it is always under test. A regulation fire alarm box will be installed at the office and upon the receipt of a local alarm the city brigade can be called from this box if desired. The equipment is being manufactured by the Northern Electric & Manufacturing Company, Limited, of Montreal, under the specification of the engineers, Westinghouse, Church, Kerr & Company. The equipment is the same as is being installed in the new C. P. R. Hotel at Calgary, and represents the very highest type of apparatus for private systems.

Montreal Electrical Society

Mr. W. J. Camp, assistant manager of the C. P. R. telegraph department, on December 1 gave the members of the Montreal Electrical Society a "Telegraph Talk." He described the apparatus used in telegraphy and traced the development of the system from its invention in 1837. At first metallic circuits were used, but these were abandoned, as the earth return was found more satisfactory. Copper wire, too, was originally employed, but it was displaced by iron wire, which in its turn gave way to a certain extent to copper when the hard drawn process was invented. The C. P. R. have about fifty per cent. of copper wire on their lines. Recorders were common in the early days, but Mr. Camp said that he questioned whether any such instruments could be found on the American continent, it being proved that operators would work more accurately and rapidly by depending upon sound alone. Mr. Camp then illustrated on a blackboard the various instruments by which duplex, diplex and quadruplex messages are sent, stating that by the latter system four messages could be transmitted simultaneously, two in each direction, while by the Rowland printing system eight messages, four each way, could be transmitted, this being the greatest number that could be sent. Automatic telegraphs were largely used in Great Britain, messages being sent up to 2,000 words a minute. There was one used on the C. P. R., but owing to the long distance the rate was about sixty words per minute. Mr. Camp described the Morcom printing telegraph system used on the C. P. R., particulars of which have appeared in the Electrical News. Girls could, he said, after six months' training, send sixty messages per hour by means of this system, while the ordinary highly efficient operator did not handle more than thirty messages. The speaker also referred to the use of automatic repeaters, and concluded by relating a number of humorous incidents of trouble on the lines and mistakes in messages.

Copper Production in Canada

The report for the calendar year 1912 of the production, export, import, etc., of copper in the different provinces of the Dominion has just been issued by the Department of Mines, Ottawa. The total production of copper in Canada in 1912 estimated on a basis of smelter recovery from ores treated was 77,832,127 pounds which at the average price of copper for the year in New York, 16.341 cents per pound, would be worth $12,718,548. Compiled on a similar basis, the copper production of 1911 was estimated at 55,648,011 pounds showing a large increase in production of 1912. The average New York price for copper in 1911 was 12.376 cents, the increase in price being 3.965 cents, or 32.0 per cent.

In the Province of British Columbia, the copper production is mainly derived from ores carrying a very low content of the metal. In the smelting of these ores the copper losses in the slag are quite considerable, reaching as high, in some cases, as 25 per cent. or more of the copper content of the ore. With ores of this character there is, therefore, a wide difference between the copper content of the ore shipped from the mine and the copper metal recovered by the smelters.

With the exception of a small output of copper sulphate at Trail, B.C., the copper production of Canada is practically all exported for refining. The exports of copper in ore, matte, regulus, etc., from Canada during the calendar year 1912 are reported by the Customs Department as 78,488,564 pounds, of which 73,176,744 pounds were exported to the United States, and 5,275,820 pounds to Great Britain. The exports in 1911 were recorded as 55,287,710 pounds, showing a large increase in 1912.

During the calendar year 1912 the total imports were valued at $7,047,356, and included crude and manufactured copper to the extent of 42,832,747 pounds, valued at $6,741,-895, together with other copper manufactures valued at $305,-461, of which the quantity is not stated. In detail, these imports comprise: copper (pigs, ingots, scrap, blocks, etc.), 7,634,539 pounds, valued at $823,374; copper in bars, rods, coils, etc., 29,520,400 pounds, valued at $4,665,791; copper in strips, sheets, or plates, 4,462,400 pounds, valued at $841,207; copper tubing, etc., 770,576 pounds, valued at $167,257; and copper wire, 444,832 pounds, valued at $101,748.

The production by provinces for the years 1910-11-12 is given in the table herewith.

Provinces.	1910.		1911.		1912.	
	Lbs.	Value.	Lbs.	Value	Lbs.	Value.
		$		$		$
Quebec	877,347	111,757	2,436,190	301,503	3,282,210	526,346
Ontario	19,259,016	2,453,213	17,932,263	2,219,297	22,250,601	3,635,971
British Columbia	35,270,006	4,492,693	35,279,558	4,366,198	50,526,656	8,256,561
Other districts*	286,000	36,431	‡		1,772,660	289,670
Total	55,692,369	7,094,094	55,648,011	6,886,998	77,832,127	12,718,548

* Includes Nova Scotia and Yukon. ‡ A shipment is reported from New Brunswick

Aluminium

No commercial ores of aluminium have as yet been found in Canada. Aluminium is, however, made in extensive works at Shawenegan Falls, Quebec, from bauxite ores imported from France, Germany, and the United States by the Northern Aluminum Company. A wire mill for the manufacture of aluminium wire and cables is also operated by the same firm.

During the twelve months ending December 31, 1912, the imports of alumina were 22,400,600 pounds, or 11,200 tons, while the exports of aluminium in ingots, bars, etc., during the same period, were 18,285,700 pounds, or 9,143 tons, besides manufactures of aluminium, valued at $10,898. The imported alumina was valued at 2 cents per pound, and the exported aluminium at 10.9 cents.

Amicable and Business-like

It is pleasing to note that the city of Chatham and the Chatham Gas Company are negotiating for the purchase of the latters plant in a most amicable and business-like manner. The city council, acting on the advice of the Ontario Hydro-electric Power Commission, have, we understand, offered the sum of $410,000 for the complete electric and gas equipment of the company, which has been accepted. While it is evident that the Commission have driven a most excellent bargain with the company, it is gratifying to note the absence of any inclination to take undue advantage of the private company. If this reasonable attitude had been assumed earlier in the history of the Ontario Hydro-electric movement there would have been less talk in financial circles of the evil effects of the Commission's operations. We trust this is a precedent of what may be expected under similar future conditions.

Electric Reduction of Iron Ores

Encouraging progress has been shown in the reduction of iron ores with the electric furnace by a recently incorporated firm known as the Moffat-Irving Electric Smelters, Limited, Toronto. No new chemical processes are involved in the production of the metal but the method of procedure differs from others in that the ore, the lime and the carbon are all introduced into the furnaces in a finely divided condition. Further, the furnace is of such a design that the ore and lime mixture falls a considerable distance through the heated carbon monoxide before reaching the reduction chamber proper. It is estimated that approximately 86 per cent. of the reduction takes place during this fall.

The general plan of the furnace is shown in the accompanying sketch which is self-explanatory. The crucible is built on a substantial base of concrete. Above this hard burnt red bricks are used and finally the main body is built up of silica brick. The hearth is of rammed magnesite.

The finely divided ore particles are fed into the upper portion of the furnace by a mechanical screw feed. The lime stone is also fed in at the same level, in the same way. The carbon, in a finely divided form, is fed in at the bottom of the stack as indicated. By this arrangement the ore and lime fall several feet through carbon monoxide gas at a temperature of something over 2,000 degrees F., which results, as already noted, in the reduction of over 80 per cent. of the ore. The carbon dioxide escapes at the top of the stack.

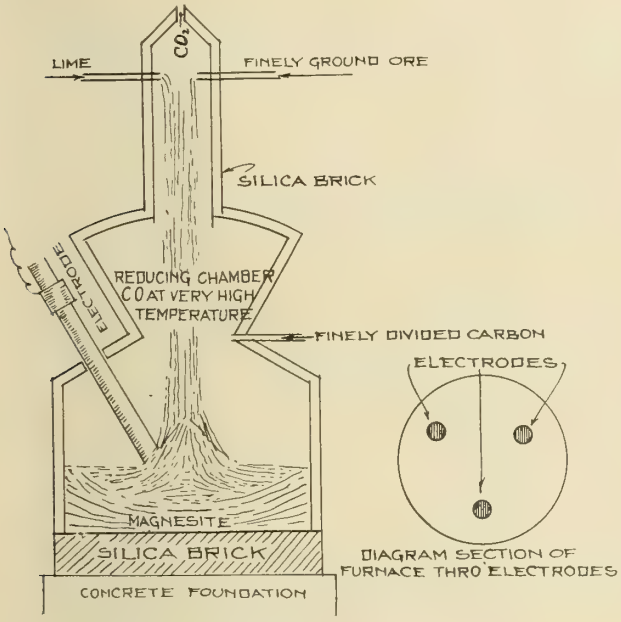


Diagram of Electric Reduction Furnace.

Three-phase current is used, the total capacity of the furnace being 300 kw. The normal voltage is in the neighborhood of 70, so that a current of about 2,500 amperes is used when the furnace is operating at full capacity. The power factor ranges around 90. This voltage can be varied, however, about 20 per cent. up or down, different voltages being found more suitable at different stages of the reduction.

Regulation of the electrodes is carried out by hand and practically no difficulty is experienced in keeping the three phases balanced. The electrodes are of graphite, 5⅛ inches in diameter. The ordinary threaded joint is used to secure a continuous feed of electrode into the furnace.

The claims made for the electric furnace are largely along the line of superior quality in the resulting steel. Its steel contains less nitrogen and especially less hydrogen than that of the open-hearth furnace where the molten metal is exposed to an oxidizing atmosphere. In the electric furnace a strongly de-oxidizing atmosphere exists. The conditions, too, in the latter furnace, permit of more thorough separation of suspended slag and the production of a metal much lower in phosphorus and sulphur.

The electric furnace at this plant operates on ore fines, —the troublesome waste product of blast furnaces—and is thus apparently destined to be a valuable auxiliary to the blast furnace.

The ultimate value of the steel being produced by this furnace can, of course, only be shown under test, though in outward appearance the castings as they come from the mould are so perfect as almost to resemble tooled steel. The appearance, however, is also borne out amply by the tests, a sample of which is given below. The content analyses were made by Kawin & Company and the physical tests by the Metallurgical Department of the Faculty of Applied Science of the University of Toronto.

An average of the last three heats made shows the following analysis:—silicon, 0.27; manganese, 0.70; carbon, 0.29; phosphorus, 0.31; sulphur, 0.31. The physical tests gave the following high average—elongation of 2-in. bar, 27.5 per cent.; elastic limit per square inch, 52,000 lbs.; ultimate tensile strength per square inch, 78,000 lbs.

At a recent meeting of the Moffat-Irving Steel Company permanent officers were appointed as follows:—J. B. O'Brian, K.C., president; James W. Moffat, vice-president and managing director; T. C. Irving, Jr., secretary and treasurer; John J. Gibson and W. H. Garvie, directors.

Loyalty in Business Life

Loyalty to the business organization of which one is a part is as necessary as faithful work. No amount of individual effort can offset a lack of co-operation. The stories of the business world's greatest success have been in a general way, the stories of harmony and team-work, which is equally as true in the electrical field as in any other department of business life.

The question of loyalty in business is discussed in the current issue of the General Electric Review by Mr. Chas. L. Clarke of the G. E. Consulting Engineering Department, and so many excellent suggestions are expressed there that we are reproducing herewith a number of extracts from Mr. Clarke's paper. If the treatment of the subject should appear somewhat disjointed the reader will please remember that these are extracts only and that such criticisms would not apply to the original paper.

"The general subject of loyalty in business life should always be of interest because it concerns certain relations between men that vitally affect their material interests. It is specially worthy of earnest consideration by the younger men, whose business careers still lie in the future, and whose habits of mind and dispositions have not become so firmly set that they should have much difficulty in subjecting themselves to a fair self-examination in the light of reason, and, if necessary, gain thereby with sensible exercise of will such control over adverse inclinations, when present, as will naturally cause them to be loyal to their business associates on every occasion.

For the purpose of keeping consideration of the subject within reasonable bounds, that we may not become lost in the mazes of a philosophical dissertation, and fail to make such practical application of its leading principles as may be advantageous to ourselves, let it here be restricted to loyalty in duties required to carry on the affairs of a corporation, which are apportioned to employees in accordance with a sys-

tem of management organized for orderly and profitable conduct of business.

The loyalty, then, that should subsist in a corporation is:

First: Loyalty to the system of management, as organized, and not, necessarily, as one may think it should be, and would like to see it organized. The system is impersonal, and comprises a code of corporation business rules and regulations, sanctioned by law and effective thereunder. It is the guide-post which points the directions in which employees should go in the line of efficient duty; if not thus guided and obedient thereto they would soon become lost in confusion. The rules and regulations of a corporation are the underlying means by which duty is assigned and directed, and anything less than faithful effort to observe them is disloyalty to the whole business in hand and to every one whose welfare depends upon its success.

Second: Loyalty within the system to the persons in whom is vested the authority to manage the details pertaining to the assignment and direction of duties. Those in authority are absolutely dependent upon the loyalty of others under them for the business success of a corporation, and they could accomplish nothing without it no matter what their own ability might be. The higher the plane of authority on which they stand, the wider becomes the scope of the undertakings for which they are responsible; the greater are the trials they have to bear, and the severer is the tax on their patience, resourcefulness, common sense and endurance to keep even themselves in every way loyal to the trust imposed upon them under the system. Thus they need the loyal support of every one else to a special degree.

Third: Loyalty within the system between those whose authority or duties are practically co-extensive. Here there should be unreservedly faithful co-operation, absence of petty jealousy, undue self-seeking, over-reaching, bickering and backbiting, which interfere with efficiency and can prove serious forms of disloyalty, and are liable, even if the seed be sown by only one person, to produce much harm and with certainty prove the truth of Poor Richard's adage, that "A quarrelsome man has no good neighbors."

Fourth: Loyalty, irrespective of the system, between all employees of whatever grade, based upon mutual respect, general good will, pride in connection with the organization and with associates, and a sincere desire to help to the best of their ability to promote success.

It is not easy for every one, and, at times, not even for those most experienced and disciplined, always to be loyal to every duty. Sometimes its performance, as the saying is, "goes against the grain," in which case such adjustment to conditions should be made that "chips do not fly." At other times its performance may seem unnecessary, or the wrong way of getting at a desired result. And these are times when loyal patience is called for, patience to wait for time to tell one whether after all he may be mistaken, or to correct a method, if later found not the best one to pursue. While it is easy to be patient under accustomed circumstances, it becomes more difficult of exercise under trying conditions, when most required, in which connection it should be helpful to remember that Poor Richard said: "What signifies your patience if you can't find it when you want it."

Temperamental pecularities seem to make it practically impossible in some unfortunate instances for loyalty willingly to exist, the misfortune being mainly harmful to those thus afflicted, for they are either certain to be kept outside the pale of organized business, or to be bound hand-and-foot by limited duties and restricted authority so that they lose opportunity for achievement and advancement that might be theirs.

Then there are some whose characteristics only occasionally cause them to clash with the business system or with their co-workers, and become disloyal by not taking up and endeavoring to perform an allotted duty in line with the directions of their superiors. The effect is disturbing, so much so as to have a correcting influence on men of intelligence toward lessening or preventing repetition of the mistake. If they prove to be men in positions of authority, Poor Richard here advises them: "He that cannot obey cannot command."

Jealousy, which in its different manifestations may be given various names but smells no sweeter therefor, is, perhaps, the most frequent cause for lapses in loyalty. It is generally of the petty, evanescent sort, and fortunately, rarely manifests itself in the region of large responsibilities. Every one knows the cure, namely, get over it; toward the accomplishment of which end the realization that all must loyally work together, if the payroll is regularly to be met, should help.

Finally, there is the cranky man, who gets at odds with the system and with his associates on the most unlooked for occasions and for inexplicable reasons. His misfortune is inability to control impulse by exercise of will power, and he should make a special study of ways and means to cure the defect. Often he is mostly of good steel; the knife passes inspection and is placed in stock although the defects are recognized, but it will not, to his detriment, be rated A-1.

The stronger the effort made by all within the various departments of any great organization to constitute themselves a brotherhood of open-minded, open-hearted, mutually helpful men loyal to one another and especially so to their respective chiefs, the nearer will be the approach of the departments to ideal efficiency in performing the functions assigned to, and expected from them."

Rules Safeguarding Human Life

The Editor,

Electrical News:

It gives me pleasure to record a few of the impressions created in my mind during a first and very memorable journey across your vast and progressive continent.

In doing so, I desire to emphasize the fact that this letter is written, not in a critical spirit, but with the sole object of mutually ventilating a subject which is already foremost in the minds of many of your leading engineers.

In order, Sir, not to occupy too much of your valuable space, my remarks must necessarily be of a brief description, and I therefore purpose to restrict my comments as far as possible to a superficial comparison of the methods adopted by our respective countries in one particular direction.

I refer, Sir, to a comparison of the electrical rules and regulations as they exist and the method of enforcing them, having regard to the safe guarding of human life.

It will undoubtedly be conceded by every humanitarian that the progress of civilization must of necessity be retarded if the problem of the life hazard is in any particular direction seriously neglected.

It will also be conceded by every practical engineer that this same problem which makes for civilization must indissolubly identify itself with the rate of progress of electricity, in respect of its widespread and multitudinous industrial application.

With this assumption conceded, it appears obvious that it should be the premier object of the governing body of every community to provide rules and regulations in connection with the use of electricity to safeguard the public as far as is reasonably possible against preventable accidents and loss of life.

The governing body having made such regulations they must have the power to enforce them and to inflict penalties for non-compliance. It is here, sir, that I find the "Great

Divide"—it is here that the ways of the Dominion and the Old Country separate.

I am advised that there are no Rules and Regulations universally adopted throughout your country which have primarily been prepared with the sole object of taking care of the "life hazard." I am advised that with certain local exceptions the National Electric Code of the National Board of Fire Underwriters is generally adopted.

Now, I submit that while admitting the excellent pioneer service of this most respected and valuable institution, and passing over at the moment the admitted technical anomalies the Code contains, such an institution, by reason of its very constitution, **cannot** be a suitable governing body to regulate in its entirety, the problem of the life hazard.

The primary object of the underwriters must necessarily be and should be to protect the pockets of their shareholders against losses by fire.

Comparisons are oftentimes objectionable, but your country teaches us so many useful lessons that you can afford to believe that in this case the comparison is not an invidious one.

In the Old Country the method of procedure is different. Rules and regulations are issued by a governing body which has the power to enforce them. These rules are widely drawn to embrace the entire life hazard and are devised to protect "the man in the street" as well as the "employee" in the workshop.

They are entirely independent of any rules and regulations, which the fire underwriters are free to devise for their own protection against fire. Great care is exercised that no particular section of the industry is unduly hampered or fostered. The engineer is not the sole arbiter. Deliberate care is taken to avoid the recommendation of any special type or shape or measurement of apparatus, thus no embargo is placed upon invention. The degree of safety to be obtained rather than the method of obtaining it, is, and should be the object of the regulations.

Every student of thought in your country will agree that it is political suicide to adopt permanently a code which selects for universal use, certain dimensioned **"types"** or **"makes"** of apparatus. It is obvious that such a course is strangling the inventive faculty of the country at its birth and incidentally playing into the hands of the monopolist. It cannot be argued that the requirements of the National Electric Code are sufficient to prevent loss of life and accident, nor can a code be called consistent which presents in elaborate detail a specification stating that a 3 ampere 250 volt switch must have quick make and quick break and a suitable cover, and at the same time allow in the same factory a switch one hundred times larger, without either quick make or quick break and **without** any grounded or protective cover whatever.

Moreover, one is appalled by the number and frequency of accidents fatal and otherwise, which occur in the workshop and elsewhere. I refer only to those accidents brought to my personal notice during a brief stay in your country. All of these accidents were preventable and could not have occurred under the normal regulations obtaining in the Old Country. Moreover, I submit that it cannot reasonably be argued that the conditions of a new country demand a sacrifice of human life and limb on the grounds of mere "cheapness." This is false sophistry and not an acceptable theory to the rigid economist. I venture, in conclusion, to put just one case to illustrate the absolute danger of an attempt to standardize too rigidly any particular "speciality."

I submit for discussion that there are at least three important grounds for objection:—

(1) A Bad Electrical Practice on Technical Grounds.
(2) A Bad Business on Commercial Grounds.
(3) A Bad Fire Hazard on Both Grounds.

(1) Bad Electrical Practice on Technical Grounds

I refer you to page 136 of the 1913 edition of the National Electric Code and to the following statement—"with link fuse cutouts there is always the possibility of a larger fuse being put into the cutout than it was designed for, **which is not true of enclosed fuse cutouts.**"

This statement being quite incorrect it is equally misleading. Wherever one goes, the private residence, the workshop, the theatre, the central station, nay even the underwriters' laboratories, one is overwhelmed with samples showing ingenious abuses of this "enclosed fuse which (the Code says) cannot be true." French nails, solid rods, brass tubes, zinc tubes, wires soldered across the old fuse case, wires twisted across the terminal contacts, and for the screw plug, the American penny, the wired cork and the more frequent "nick" with the pocket knife—and yet the Code still says—"It is **not true** that the enclosed fuse cutout admits **the possibility** of a larger fuse being put into it."

I submit, Sir, that it is never wise to commit to print a statement which cannot be established, and which the underwriters' engineers themselves do not attempt to defend. It can only serve to discredit in the minds of the uninitiated the other parts of the code regulations which are good.

It should be assumed as a basis of reasonable argument that at some time or other in the life of every pair of fuse terminals there will come a moment when through some reason or other there is no spare cartridge at hand. Numerous causes may account for this:—

(a) Demand exceeding supply.
(b) Shipments lost or late in transit.
(c) Consumer omits to order spares, etc.
(d) Consumer realises that the condition of his electricity supply never warranted the introduction of the extravagant cartridge.

Obviously the consumer cannot allow his factory to stand still—he must try some temporary expedient, and invariably he **does.** It is here the Code fails conspicuously—it is here the risk of fire is increased, for not only is the **length of air break too short** to give reasonable protection, but the very nature of the terminals are the worst that could possibly be selected for the purpose.

The alternative method of course is to provide ample length of break and ample spacing for an open link fuse to break in air, and to provide a proper system of clamping for the fuse link, and finally to make it compulsory that **every fuse,** irrespective of its design must be enclosed in a suitable cabinet, so that under conditions of normal use or **abuse** there is no danger of the melted fuse coming in contact with any substance which might be ignited thereby (see Code page 136).

The judicious use of cartridge fuses, under these same terminals must be a question depending upon the conditions and pressure of the electricity supply. It must obviously be a question of education as between the supplier and the consumer. It is very significant when the electrical department of the city of New York consider it necessary to state in the latest edition of their electrical code (see page 157) "owing to the difficulty of making proper inspection of the fusing where fuses of the cartridge type are used, it is strongly recommended that this type be not employed where plug or link fuses may be installed."

(2) A Bad Business on Commercial Grounds

I am given to understand that the largest number of enclosed fuses are used on an alternating current voltage, not exceeding 110 volts. Everyone knows that an alternating current at this voltage presents little fusing difficulty, and to use a cartridge every time a fuse melts is very wasteful. Multiply this proposition by a million consumers and you have a national economical calamity. It is an undeniable fact that hundreds of thousands of dollars are wasted annually upon the

American continent by the wasteful use of cartridge fuses upon conditions of low voltage where their use is not warranted, and where an open link fuse in a suitable cabinet, would provide a lessened fire risk and a great saving in cost of renewals.

I do not wish to be misunderstood on this question. As a manufacturer I am an interested party and therefore biased in favour of the cartridge fuse, and I am fully alive to the necessity of its judicious use, particularly upon continuous current circuits. A properly designed cartridge fuse is the only fuse I know that can be relied upon to successfully negotiate a "dead short" under the most adverse conditions, but I say it with deliberation—the case for the cartridge fuse is, in my opinion, being prejudiced and its **abuses** encouraged by "indiscriminate recommendation." It is common knowledge that "over organization" can become an incubus; in like manner the ingenious plea of "interchangeability" can be so exaggerated that it becomes a fetish.

(3) A Bad Fire Hazard on Both Grounds

It is obvious from the wording that when the Code was first arranged it was either wrongfully or carelessly assumed that a form of cartridge and plug fuse had been invented which "could not be tampered with," and in consequence permission was given for such apparatus to be used without other external protection. Now that it is discovered that such fuses are recklessly abused, not only by the ignorant, but also by engineers themselves, the whole case for the use of the cartridge fuse without other protection fails.

If an N. E. C. standard fuse is tampered with and there is no external cover, the risk of fire through melted fuse metal coming in contact with any substance which might be ignited thereby (see Code page 136) is very great.

I submit, Sir, that here at least is a matter for the urgent and immediate attention of the National Board of Fire Underwriters. They have the advantage of possessing a distinguished staff, conspicuous for ability and for courtesy, and fully conscious of anomalies which exist in their Code and anxious to redress any just grievances.

It remains for the electrical trade and the public alike, irrespective of nationality, to assist them to make bold use of the pruning knife, to make the Code consistent and efficient, to model it so that according to the requirements it deals equally and fairly with the best accepted electrical practice, not of any one particular country but of every country irrespective of origin, and to fight courageously at all times the engineered opposition of the monopolist.

I am, Sir,
Your obedient Servant,
Herbert H. Berry,
Member Institution Electrical Engineers.
Member Engineering Standards Committee.
Member National Electrical & Allied Manufacturers' Association, Incorporated,
of Great Britain.

Conservation of Our Resources

Mr. P. W. Ellis, chairman of the Toronto Hydro-electric Power Commission recently delivered an address before the National Municipal League on the operation of the Toronto municipal plant, in which he outlined the history of the municipal movement in Ontario from its inception in 1900 to the present time. Mr. Ellis' remarks with reference to the necessity of this movement to offset the depleted areas of coal and the possible prohibition of exportation from the United Stated, are very valuable as pointing out to Canadians the necessity of conserving all their water powers for their own use. Mr. Ellis' remarks on this matter follow:—

"The question of motive power in the Province of Ontario is a vital one. With a population of about two and one-half millions, or one-third that of the whole Dominion, the value of its manufactured products in 1910, was estimated at $580,000,000, or as much as the manufactured products of the whole of the rest of Canada. In the maintenance and development of this vast and complex workshop, it is hard to overestimate the influence of cheap electric light and power. While the Province is enormously rich in agriculture, timber and certain minerals, it has no coal resources. Substantially the whole of the coal used in the Province comes from the Pennsylvania coal mines. There are coal deposits in Western Canada and in Eastern Canada, but the cost of transportation forbids their profitable use in this Province. In the year 1909 six and three-quarter million tons of bituminous coal having an entry value of $13,000,000, were imported into Canada, almost the whole of which represented Ontario imports from Pennsylvania mines, upon which the manufacturers of this Province paid a duty of upwards of $3,000,000.

With the growth of manufactures, which in Ontario is proceeding at an unparalleled rate (the output for 1910 being nearly 250 per cent. of that for 1900) there will be a corresponding increase in coal consumption or in that of an equivalent substitute. The coal beds of Pennsylvania, however, are being depleted, and there is no assurance that even while their supplies last they will be available for the use of the manufacturers of this Province.

In the absence of a competing substitute for coal being made generally available, it is inevitable that the price of Pennsylvania coal will steadily increase, while it is also possible that national necessities may, at some future date, lead the United States to prohibit the exportation of coal from the diminishing resources of Pennsylvania. The ultimate effect of either of these conditions upon the manufacturing interests in this Province would—if it were not neutralized by the development of our water power resources—amount to a most serious calamity.

For the ingenuity, the enterprise and the generosity of the great mass of the people of the United States, we in this Province have the most profound admiration, and if, under the necessities of unchangeable natural conditions, the coal supplies of Pennsylvania were by legislation denied to us, we could not quarrel with the policy of a friendly sovereign state, dictated by such conditions, while we might well be seriously alarmed by the magnitude of the consequent disaster.

Our manufacturing status and our competing power at home and abroad depend upon our ability to procure ample supplies of motive power and light on favorable competing terms. Either of the foregoing conditions, would, if not overcome by our Hydro-electric policy, place a permanent and increasingly heavy brake upon our manufacturing activities. We would require to bring coal in at abnormally high prices from the far East or the far West to the surrender of our present position of manufacturing pre-eminence and to the consequent destruction of much of our enormous capital investments with the further effect of seriously arresting our national development.

The conditions and possibilities thus briefly outlined will suffice to indicate the tremendous importance to us of procuring as best we can, adequate supplies, at the cheapest rates possible, of that motive power without which, our manufacturing supremacy in Canada and our manufacturing position in the markets of the world cannot be maintained."

The paper further dealt in brief detail with the physical aspects of the Toronto system, its cost and the rates charged. Regarding the setting aside of depreciation and sinking fund allowances, yearly, Mr. Ellis has this to say:—

"It is, perhaps, interesting and instructive to note that a commercial company always raises a large part, when not the whole, of the funds required to provide for construction ex-

penditure by means of perpetual share capital. As the moneys so raised do not require—apart, of course, from the liquidation or selling out—to be returned to the shareholders, it is not necessary in such cases to load the rates with any sinking fund designed to repay the capital. In the case, however, of a municipal undertaking, such as the present, the conditions are entirely different. The undertaking has no capital as such. It is built out of the proceeds of debentures which require to be paid off at maturity. Unless, therefore, the rates are loaded with an adequate sinking fund charge, the accumulation of which extinguishes the debt at maturity, it would require to be paid off at the expense of the ratepayers at large. It is sometimes suggested that to load the rates not only with an adequate allowance for the sinking fund obligations, but also with proper allowance for depreciation, is unfair and that such policy would impose such a burden upon any undertaking submitted to it that it would necessarily lead to disaster. It might be well to examine this question. It is a very simple one. Depreciation is a grim reality. No undertaking, whether commercial or municipal, can escape it. The world goes on improving its instruments and methods of production, rendering obsolete in consequence antecedent methods and instruments without regard to individual wishes. Wear and tear operate continuously upon all apparatus subjected to its influence, without regard to municipal resolutions or to doctrinaire theories. Unless, therefore, funds are accumulated out of rates, to make good the inroads of the two influences in question, they must be obtained from other sources. This means, in a municipal utility of this kind, that unless the rates are loaded to provide these funds, there must be continual applications to the ratepayers at large, for authority to issue further debentures from time to time for capital replacements, or in the alternative, they must confer a discretionary power upon the Council for such further issues as may be required.

I do not know of any course that is more likely to undermine public ownership sentiment than to adopt a policy under which the ratepayers are asked to sign in advance a blank cheque or to submit to constant applications for further grants in aid of capital replacements. It is a simple matter to go to the ratepayers for $10,000,000 to build an undertaking, and five years afterwards for $5,000,000 to enlarge the undertaking, upon the understanding that it will be conducted on absolutely self-supporting principles. When 30 per cent., 40 per cent. and 50 per cent. reductions, from existing light and power rates can be shown to follow the establishment of self-sustaining municipal plants, the ratepayers can usually be relied upon to sanction the necessary municipal debt, but if it should be explained to them that such undertakings shall not be made self-supporting and that in consequence the original debt which they are requested to authorize is to be followed at periodic intervals by further issues of debenture debt to replace depreciating physical assets, their fears of a needless expenditure may well be excited to the point of refusing it altogether.

In regard to the remaining question as to whether the imposition of the double burden of depreciation and sinking fund upon the rates may not prove intolerable, it is enough to say that those who indulge in such fears have given no adequate consideration to the matter. Our own experience—and it is not yet two years since we commenced operating in a real way—has taught us that the rates quoted above, which are greatly less than the pre-existing commercial rates, are amply sufficient upon a reasonable volume of business to bear the double load, and as business increases to accumulate surpluses which will be available either for the purpose of rate reductions or capital expenditure enlargements as may be deemed best."

The speaker stated that the results to date have been very satisfactory. At the beginning of November, 1913, they had approximately 22,122 complete services with a connected load of upwards of 75,000 h.p. 35,000 lamp units have been installed to date on the city streets. A surplus over all charges for the year 1913 of over $100,000 is expected.

Regarding the effect of competition Mr. Ellis adds:—

"The competitive effect of the establishment of the civic plant has not been destructive as was freely predicted at the time of its inception by its commercial competitors. The fact of the matter is that the potentialities of the power and light business are so great that few companies enjoying a monopoly thereof are alive to their posibilities. The rates of the competing commercial company in this city have been reduced to meet our own. There has been a very great advance in the quality of the service given to the citizens and a very great increase in the activity and intelligence with which business is cultivated. The cheapening of the rates and the extension of the uses to which electricity is now put, is having the effect of greatly increasing its total sale in this city, and province."

Electrical Situation in Winnipeg

Mr. H. A. Robson, Public Utilities Commissioner of Manitoba, gave out a statement showing the financial position of the light and power department of the city of Winnipeg as at April 30th, 1913. As this is the first complete statement of operation of this system we are printing extracts of it below. The figures go to show that up to the date named the deficits aggregate $142,274.64 and the total expenditure was $6,623,665.56.

A statement is also handed out regarding the financial position of the Winnipeg Electric Railway System and two of its subsidiaries, namely, the Winnipeg, Selkirk & Lake Winnipeg and the Suburban Rapid Transit Company. The net revenue of the street railway department of the W. E. R. Co. for the year ending December 31, 1912, was $748,972.-04; the net revenue from the electric light and power department was $373,677.26; the net revenue from the gas department was $71,813.82. This gives a total net revenue from these three sources of $1,194,463.12. After deducting common stock dividends of $720,000, there is a surplus for the year of $474,463.12. The total assets of the company are placed at $19,461,624.89.

The financial statement of the Winnipeg, Selkirk & Lake Winnipeg Railway shows that the net income from this subsidiary was $9,499. A net deficit was shown by the Suburban Rapid Transit Company of $43,469. No dividend was paid on the common stock of either of these subsidiaries.

Following is the statement of Commissioner Robson regarding the Winnipeg light and power system.

Winnipeg's Municipal Plant

The practical application of the accounting provisions of the Public Utilities act to utilities is being gradually attained. The three most prominent utilities are the Manitoba Government Telephones, the Winnipeg Light and Power Department and the Winnipeg Electric Railway Company.

The purposes of supervision of accounting in the case of utilities constructed out of public moneys is different to that where the concern is privately owned. In the latter case accounting to a commission shows what is being made out of a franchise. The effect on rates and betterment of service is also a feature. In government and municipal ventures the application of the public money is an additional element not present in private enterprises.

In June last accounts of the city light and power department were filed with the public utilities commission for the year ending 30th April, 1913. These accounts evidently

required expert consideration, and they were submitted by the commission to Mr. John Scott, C.A., for examination.

With slight exception the depreciation percentages proposed by the city's manager in respect of plant were adopted. Besides depreciation of physical assets, such items as interest during construction, and costs of financing, are to be amortized by distribution over proper periods.

Two important questions regarding depreciation came up. First as to the period at which the depreciation reserve account would be started. The plant commenced operation on the 1st November, 1911. It was thought expedient to give a year's time to get the business going without burdening the accounts with depreciation charges, so that in the revised balance sheet for the year ending 30th April, last, depreciation is charged for but six months, i.e., from the 1st November preceding. The depreciation for the six months was $99,662.32.

Yearly sinking fund payments to meet the debentures are less than the depreciation amounts. It was thought unjust to those of the present time, and unduly beneficial to the future, that both sinking fund and depreciation reserve should be set up so that it is provided that out of the depreciation reserve may be taken whatever sums are necessary to pay to the sinking fund trustees.

The reserve accounts include sinking fund items for a short period before the depreciation charge commenced, hence the difference between the depreciation charge and these reserves. The main sinking fund payments on the debentures were not required to commence until one year after the plant commenced operation. The commencement was 1st November, 1911, so that it is only from the 1st November, 1912, that the plant has been carrying its real financial load. Henceforth the plant will set aside depreciation out of which the sinking fund payments will be taken. It will not be required to provide both.

The examination conducted by Mr. Scott, the commission's accountant, was not pretended to be an exhaustive audit. Nevertheless a great deal of time was taken in eliciting information and in discussing with city representatives and officials the points which presented themselves on the surface. The revised balance sheet recently completed, and now published, is the result.

When the accounts of April 30 last were filed they were accompanied by a notation that they did not contain certain items to be charged when audited. These items were:

Accounts payable—

Capital	$74,918.53
Stores	39,825.39
Operating	11,501.20
Accrued interest on stock and debentures	34,559.69
Wages	7,653.85
Accounts receivable	70,444.43

These items are included in the accounts now furnished.

It is to be remarked concerning accounts payable that heretofore, whether because of haste in construction or otherwise, there has been a lack of record of the obligations of the department on current account. Uncertainty as to exact standing of accounts payable has resulted.

The accounts originally published showed an actual capital expenditure up to 30th April, 1913, of $5,759,169.09. The accounts now show expenditures $6,143,693.04 as of that date. The difference is made up as follows:

Outsanding bills payable—

Water power	$ 98,921.84
Conduit construction	280,069.56
Conduit construction—	
Bills payable	5,532.55
	$384,523.95

The outstanding bills payable on capital account is one of the items noted above, but shows an increased amount.

The conduit expenditure was omitted previously because it was thought to belong to an independent city account as being authorized under separate legislation. It is now to be considered part of the Hydro-Electric system.

The stores item was given at $195,065.19 in the first statement. The figure for stores in the present balance sheet is $237,900.14. An inventory is produced showing as of the same time stock valued at $261,034.40. The city officials report that they are now inquiring into these figures.

Joint use of poles investment not in original balance sheet, now appears at $5,344.71.

The depreciation and sinking fund reserves are now given at $117,891.08 instead of $66,149.52.

Differences in stock issues and bank loan appear. They are evidently due to the introduction of the conduit expenditures previously omitted.

The deficits up to 30th April last, formerly given at $111,866.22 are now stated at $142,274.64.

Outstanding accounts as of the 30th April, 1912, had been brought into the revenues of the year 1912-1913. It is said the amount cannot be exactly arrived at so as to be excluded, and that it amounts to a figure in the neighborhood of $7,000.00. The accounts have not been disturbed to meet this point.

In the item above mentioned, accounts receivable, no provision was made for bad debts. These have now been estimated at $7,711.47 and a reserve set up therefore.

Objection was taken by Mr. Scott to the capitalization of the cost of government inspection, installation and removal of meters. The inspection and installation are to remain as capital items, but removals are to go to operating account.

A stores and supplies item not included in the one above referred to, gives rise to difficulty. There stood to the debit of this account the sum of $77,113.45. But the material had, it is said, gone direct into construction in the early stages, without being accounted for through the stores department. The item is now closed by being carried to overhead distribution.

To an equipment account there is charged $27,824.92. So far the facts as to this have not been definitely ascertained. It is said there is no inventory, and the amount should be transferred to a construction account.

Dealing with the accounting system. Mr. Scott says:

"Shortly stated, the expenditures are recorded in the ledgers (capital and operating) kept by Mr. Manley at the city hall. The revenues collected are paid in (including those collected at various centres in the city) to the city treasurer, and the records of the different sources of income from the plant are kept at the King street office, while the stores—a large figure—are kept at James street. There may be advantages in this method—but with me it is an axiom that the only proper place to perform the accounting of any business is where the business is carried on. I think it can be truly affirmed that in the case of an electric light system, the place of business is where orders and contracts for lighting and the supply of current are entered into, bills made out, and records thereof kept and not least, but most, where the manager is to be found. In Winnipeg's case, the place of business in my opinion is the King street office, and it is there that I would recommend the accounting staff to be placed. None can have more pride in the success of the undertaking than the managers in charge, and I think it an altogether unfair handicap if they do not have the accounting staff to appeal to in all matters pertaining to the result of their opertions.

"It need hardly be added that the accounting affairs of the system are such as to demand the services of thoroughly competent accountants, who will be free to give their whole

time and energies to the work, and who will be prepared to make a study of electric light accounting, and as soon as may be inaugurate whatever needed cost and other accounting may be necessary to keep pace with the development of the undertaking in its various departments."

City of Winnipeg Hydro-Electric System, Year Ending April 30, 1913

Operating Revenues—	
Commercial lighting	$286,437.50
Commercial power	71,954.59
Municipal street lighting	28,921.94
Municipal buildings lighting	13,662.35
Municipal power—waterworks	64,198.27
Municipal power—Miscellaneous	2,467.82
Tramway earnings	6,649.13
Accounts receivable at 30th April, 1913	70,444.43
	$544,736.03
Operating Expenses—	
Power (schedule)	$25,616.70
Transmission and transformation (schedule)	37,573.81
Distribution (schedule)	41,969.76
Consumption (schedule)	6,947.14
Commercial (schedule)	64,701.54
General (schedule)	17,079.15
Tramway (schedule)	17,035.58
Undistributed (schedule)	54,220.41
	$245,144.09
Depreciation six months (credited to depreciation reserve)	$99,662.32
Taxes	3,045.95
	$102,708.25
Total operating expenses	$347,852.34
Net operating revenue	196,883.69
Non-operating revenues	908.15
Income	$197,791.84
Deductions from income—	
Interest on funded debt	210,649.55
Interest on floating debt	70,575.19
(Contractural sinking fund requirements, $43,843.30 charged to depreciation reserve)	281,224.74
Deficit for year	$83,432.90
Deficit at beginning of year	58,841.74
Deficit at close of year (as per balance sheet)	$142,274.64

Balance Sheet as at 30th April, 1913

ASSETS

Property and Plant—	
Water power construction	$3,605,321.39
Distribution system	2,012,796.79
Hydro-electric system extension	19,691.00
	$5,637,809.18
Discount and expenses, stock and debentures sold	121,359.91
	$5,759,169.09
Conduits	280,069.36
Accounts Payable—	
Water power	98,921.84
Conduits	5,532.55
	$6,143,693.04
Current Assets—	
Accounts receivable	$70,444.43
Stores	237,900.14
Electrical appliances	3,408.20
	$311,752.77
Investments—	
Sinking fund trustees	$20,436.52
Other Assets—	
City and Winnipeg Electric Railway, joint use of poles	$5,344.71
Consumers wiring and installations	163.88
Deficit	$142,274.64
	$6,623,665.56

LIABILITIES

Stock and debentures	$6,542,000.00
Less unsold at 30th April, 1913	934,375.00
	$5,607,625.00
Current Liabilities—	
Accounts payable	160,548.67
Bank of Montreal	694,039.79
	$854,588.46
Accrued Liabilities—	
Unmatured interest on debenture debt	35,849.55
Depreciation reserves	117,891.08
Uncollectable accounts	7,711.47
	$6,623,665.56

Personal

Mr. A. L. Mudge has returned from England where he has spent a few weeks combining business with pleasure.

Mr. E. W. Sayer, of the Sayer Electric Company, Montreal, is a candidate for alderman of the St. Lawrence Ward.

Prof. L. A. Herdt, of McGill University, has been appointed by the city of Quebec to advise on electrical conditions in that city.

Mr. Herbert S. Holt, president of the Montreal Light, Heat and Power Company, has been appointed a member of the McGill University Board.

Mr. J. D. Lachapelle has severed his connection with R. E. T. Pringle and will continue the business of engineers and manufacturers' agents under the name of J. D. Lachapelle & Company with offices at 519 Canadian Express Building, Montreal. Mr. Lachapelle is well known in the Canadian electrical field having been associated with the electrical busi-

Mr. E. J. Latta, for the past two years on the editorial staff of the Electrical Review & Western Electrician, has entered the employ of the Underwriters' Laboratories as special agent and will spend most of his time on the road for this organization. Mr. Latta brings much experience both of a technical and practical nature to his new work. He is a graduate of the University of North Carolina and of the Graduate School of Harvard University, and has at various times held important positions with the Westinghouse Companies, the University of North Carolina and the General Electric Company.

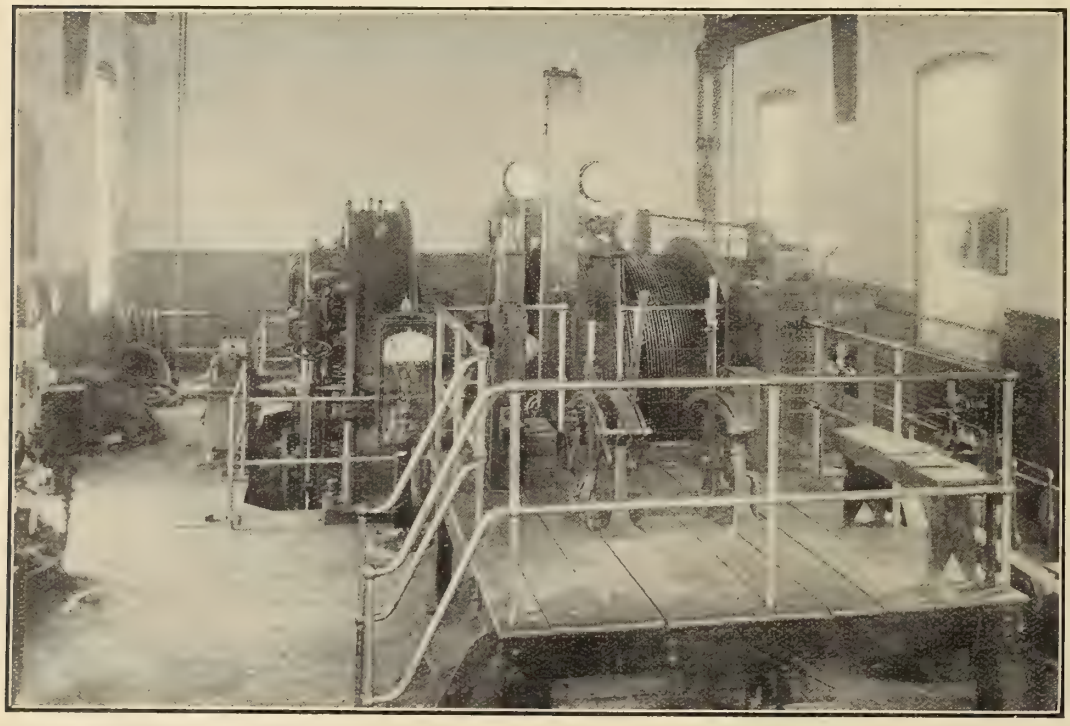
Never mind reverses if they come. Fight on Keep on, on, on, meeting success without exultation, facing reverse without despondency.

An Electric Hoisting Installation

The Dominion Coal Company have recently installed an electric hoisting engine in their New Waterford collieries and a brief description of the equipment will prove interesting to those connected with modern colliery hoisting practice.

Electrically-operated hoisting engines belong to three distinct groupings; Ward Leonard, Ilgner, and straight 3-phase. The engine described herewith, known as a No. 14 colliery hoisting engine, is designed to work in the first grouping, and this article will explain the Ward Leonard operation from the point where the Dominion Coal Company's high tension transmission lines enter the hoisting engine house. This building is built high enough to allow for a ten-ton travelling crane which is used to move the heaviest part of the machinery without being cramped for room.

As the Dominion Coal Company's current supply is high voltage, alternating current, a motor generator set has been installed. This consists of an 800 h.p. slip-ring induction motor directly coupled on the same shaft with a variable voltage d.c. generator, 0-600 volts; also an overhung type exciter, which supplies the exciting currents to the variable voltage generator and the separately excited field of the low speed direct current winding motor. The motor operates at 740 r.p.m., on 6600 volt, 25 cycle current. The current for this motor comes into a single concrete cell section built in the basement of the engine house, and passes through isolating links and an oil switch which is operated by remote lever control from the high tension switch panel on the engine room floor above. Current and potential transformers are used in connection with the circuit for measuring the necessary power. This motor is supplied with special short-circuiting device so that when the set has been gradually run up to speed by a small liquid starting apparatus the slip-rings are short-circuited, the starter is cut out of circuit, and the brushes automatically lifted from the slip-rings. Running under such conditions, the motor works most efficiently because no external leads offer resistance to motor currents. Further, there is no wearing of slip-rings or brushes which is important considering that the set runs continuously day and night throughout the six working days of every week in the year.



Hoisting equipment in New Waterford collieries—Dominion Coal Company.

The generator is a variable voltage type capable of supplying 0-600 volts to the winding motor, the normal current being 980 amperes to 1850 maximum during acceleration or what is termed "peak load." This generator is of the ordinary shunt wound type with commutation poles and has also a compensating winding for eliminating armature reaction. A special feature is a double section air-cooled commutator —the fan is built between the commutator sections in such a manner that each fan blade connects opposite commutator segments. The commutator is hollow and air, drawn through by the fan, keeps the commutator cool whatever the load or atmospheric temperature conditions in the engine house.

The exciter is a small overhung compounded generator working at 230 volts, which supplies all the necessary exciting current to distributing busbars mounted on a low tension direct current panel next to the high tension panel on the engine room floor. Fixed to the end of the overhung exciter is a centrifugal switch which automatically stops the winder should the converter set tend to run about 15 per cent over speed.

The main armature connections of the variable voltage generator and winding motor are electrically coupled without the interposition of switches. The winding motor is for a peak load of 1320 h.p. and is somewhat similar in construction to the variable voltage generator having interpoles and compensating winding. It is a large slow speed multipolar machine rigidly coupled to the shaft of the winding drum.

The winding drum is 8 ft. in diameter, and the rope tread is cylindrical and of solid cast steel section. Each side of the drum has a steel plate brake-path 9 ft. in diameter, bolted to the main drum casting. Two pairs of hardwood lined brake posts engage with the brake paths of the drum. Both brake post units are mechanically linked so that one brake lever operates both simultaneously. The Whitmore patent "take up" gear is fitted and this automatically takes up any wear of the wooden blocks and always keeps the air gap, when the brakes are off, equal. Thus the power of the brakes remains the same for any wear of the wooden blocks. The brake engine is supplied with air from a small electrically driven compressor, which automatically stops and starts as the air pressure rises and falls beyond the fixed limiting values by an air operated piston switch in the motor armature circuit. The current for the motor is taken from the low tension panel exciter busbars.

The driver operates the whole mechanism from the platform with perfect accuracy and without any physical exertion.

Before him are three levers, (1) the lever which operates the Ward Leonard rheostatic controller, the resistance of which is in series with the field of the variable voltage generator, (2) the lever which applies the mechanical brakes, and (3) the lever which cuts

current off the winding motor and automatically applies the brakes through tripping links. This lever is termed the emergency brake lever. The emergency brake also comes into operation automatically from the following causes: (1) In the event of an overwind, (2) if the transmission supply power fails, (3) if the air operating the brake engine fails, (4) if the winding motor is overloaded more than a certain allowable amount, (5) if the converter set overspreads more than a certain allowable amount, (6) if the excitation current fails.

In front of the driver, a column depth indicator is placed, by means of which the driver sees exactly the position of boxes on the main slope track. The safety gear on this depth indicator is in direct lever connection with Ward Leonard lever No. 1, and prevents the driver accelerating too rapidly or overwinding, and in the case of vertical shafts also prevents him retarding the winding motor too quickly. The counter shaft of the indicator also drives a tachograph.

In the Ward Leonard system, the mechanical brakes during normal operation are only used to "hold" the load. Braking is done rheostatically with the electrically coupled armatures of the winding motor and variable voltage generator. It is almost impossible for the driver to make a mistake and perfect safety is assured when winding men.

The No. 14 engine is designed to hoist 185 short tons of coal per hour up a 25 per cent. gradient shaft 5,000 feet long at 30 ft. per second. The No. 14 slope at present has only a single track and the engine hoists coal from any landing, sending the empty boxes back into the mine under unbalanced load conditions, so that the converter induction motor is caused to run above synchronous speed, and power to the value of 150 kw., when rope speed is at 30 ft. per sec., is pumped back on the transmission lines. The greater the unbalanced load, of course, the greater the amount of power returned to the line.

The record of this engine up to the present is 1860 boxes in ten hours working and the average weight of coal per truck is 2,000 lbs.

The whole of the above equipment was supplied and installed by the Siemens Company of Canada, Limited, who have also delivered or have on order two 1900 h.p. and one 400 h.p. peak load electric hoisting engines for the same company.

Megantic to Have Hydro Plant

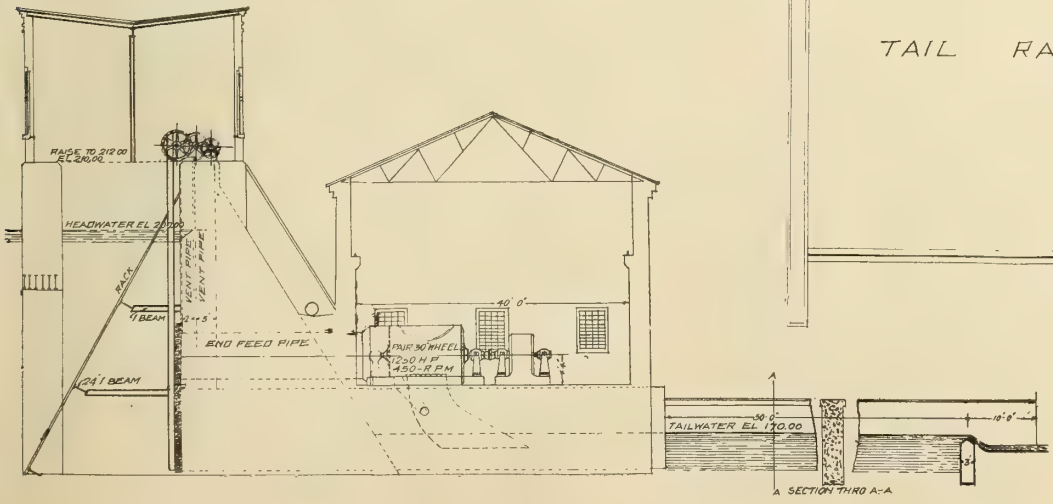
The corporation of the town of Megantic are installing a hydro-electric plant according to plans shown herewith. It will be seen that the power house and auxiliary works are planned for two units of 750 kv.a. capacity, but only one of these will be installed immediately. The dam will be of concrete, 625 feet in length with an overflow crest of 325 feet and a head of 30 feet. The water will be carried by a 7-foot penstock for each of the generating units. Each turbine will consist of one pair of 30-inch wheels and will have a normal rated capacity of 1,250 h.p. at 450 r.p.m.

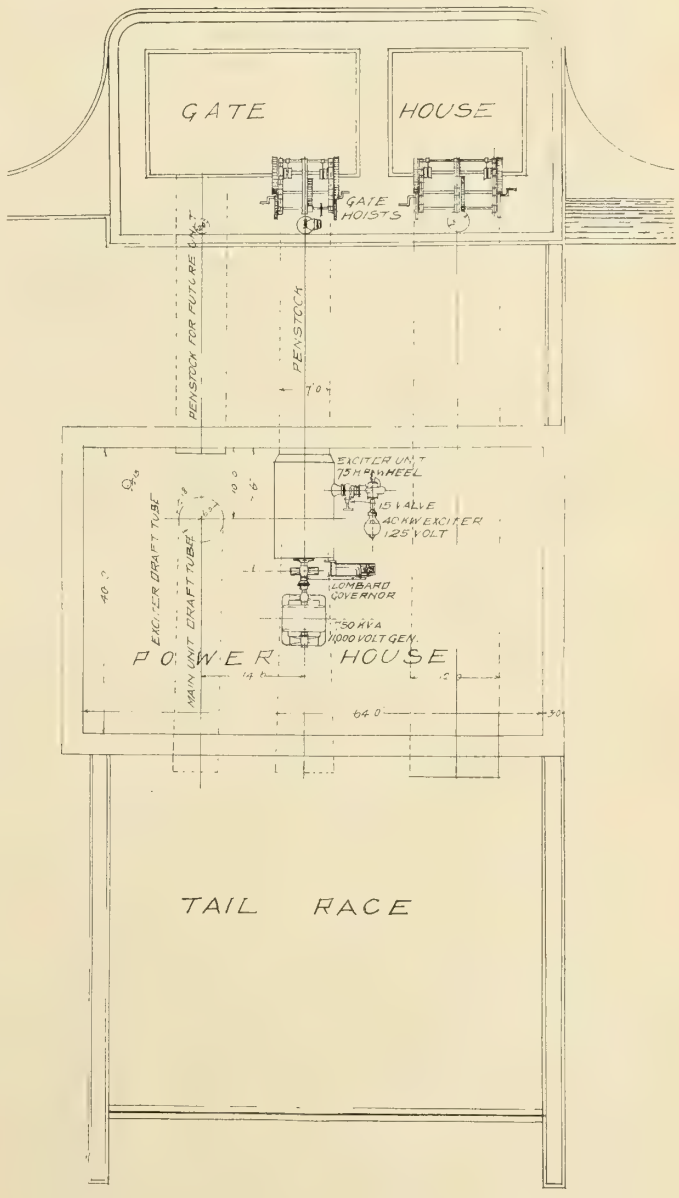
The exciters, of which there will be one for each unit, will be 40 kw. capacity, 125 volts. These will be driven by 75 h.p. wheels, the water being fed to these by a branch from the large penstock. After passing through the exciter turbine the water will discharge into the draft tube of the main unit to which it corresponds. Each turbine will be ergulated by a Lombard governor.

The generators, only one of which is being installed at present, are of the horizontal type, 750 kv.a. capacity, 11,000 volts. There will thus be no step-up transformer equipment required as transmission is at this voltage.

As shown in the power house section, the main building is being planned for the installation of a travelling crane.

Mr. Edward A. Evans, Mem. Can. Soc. C. E., is consulting engineer for the corporation of Megantic.





Section and plan of Municipal water plant being installed for Megantic, P Q.

Testing of Telephone and Telegraph Lines

By Mr. T. H. Nicholson

Line Testing With a Voltmeter

It would not be practicable to simply have a voltmeter and connect it to a line when a test is required, without having some convenient means of quickly changing the circuit for the various conditions met with, and so obtain a complete test. Therefore, it is customary to arrange a series of switches or keys so designed that when one key, or a definite combination of keys, is operated, a certain known condition of the voltmeter circuit is in effect. Then again it is necessary to transfer the talking and ringing circuits on to the line, or to use them in connection with the test circuit. It would seem then that the design of a testing keyboard is quite an important matter, and just as necessary as suitable instruments and efficient methods.

There are two general methods or principles employed in testing circuits. The older of these is to use a battery that is permanently grounded, and with a circuit that connects the free end of the voltmeter circuit alternately on each side of the line, with another ground connected on the opposite side to test across.

Fig. 16 shows a skeleton circuit of this arrangement and illustrates the method of changing the circuit by means of ordinary telephone keys. For the sake of simplicity, all other keys, such as those used for connecting the shunt coil, for talking, listening, etc., have been omitted. When the VM key is operated, the battery flows through the voltmeter and reverse key directly to L_2 on the line, and if a ground is on that wire the voltmeter will be deflected to an extent depending on the resistance of the short circuit and of the earth return itself. When the VM and reverse keys are both operated the testing battery similarly flows to the L_1 side of the line, and likewise to any "ground" that may exist on that wire. When the "VM" and "ground" keys are operated the battery flows out over L_2 as in the first instance, and, if there is a cross between L_1 and L_2, back over

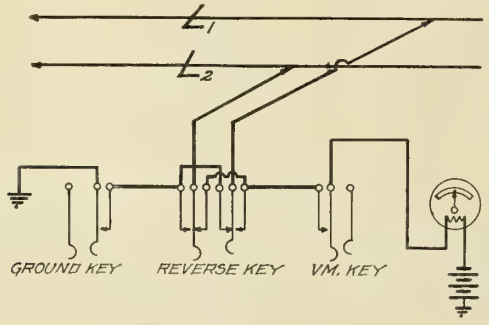


Fig. 16

L_1 to the ground applied by ground key. If the reverse key is operated during this test the only result is to reverse the direction of current.

Figures 17, 18 and 19 show the actual circuit condition when making these tests, and show how the fault, as denoted by "X" in each case, is detected. In Fig. 17 the voltmeter, when applied to L_2 with the "VM" key, is deflected a certain amount, showing a ground to exist on that wire. Similarly when the "reverse" key is operated and the circuit is changed as in Fig. 18, a ground is shown on L_1, and when the "VM" and "ground" keys are operated a cross is detected as shown in Fig. 19.

Referring to Fig. 17 and assuming that the deflection was 20 on a 30-volt scale, 1000 ohm instrument, it would seem that the "ground" according to the rule already given, must be at a point on the wire corresponding to 500 ohms, but on trying to locate this from the known length of the line, this calculated point is found to be some distance beyond the end of the line. Obviously then there must be some resistance in the cross between the wire and ground. This is nearly always the case, and it is therefore necessary to determine this extra resistance in order to make an actual location.

This can be done directly with a Wheatstone bridge, but it is often desirable that it be done with a voltmeter, and as

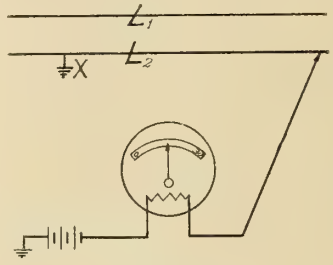


Fig. 17

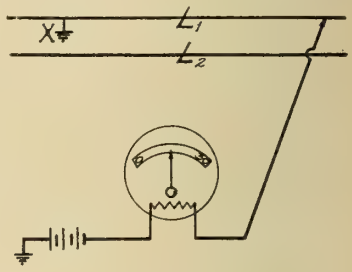


Fig. 18

there are probably quite a number of testboards using this general principle of testing, a method of making this location is given herewith.

The L_2 side of the line, as assumed above, shows a resistance to ground, which we may call "X," of 500 ohms. A subscriber is called, and while he has his receiver off the hook the voltmeter is applied to the L_1 side of line as shown in Fig. 20, where the cross at the end of line represents the sub-station. A deflection of 16 is now obtained, giving a resistance of 875 ohms. This resistance, which we will call "Y," includes the L_1 side of the line, the sub-station, that part of L_2 from the sub-station to the "ground," and the "ground" itself. If we ignore the resistance of the "ground" the line must measure Y + X or 875 + 500 = 1375 ohms.

Now, from a separate test, or from the records, we know that the line, including the sub-station, only measures 775 ohms, so the difference must be due to the resistance of the ground. This difference, 1375 — 775 = 600 must be divided by 2 since the ground was twice measured, once over L_2 and again over L_1. The actual resistance of the ground then is 300 ohms. Since 500 ohms include L_2 to the ground and the ground itself, the remainder, 200 ohms, is therefore the resistance of L_2 to the cross.

Evidently a ground on the L_1 side can be located equally

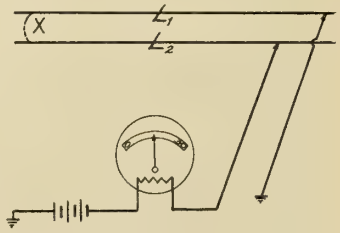


Fig. 19

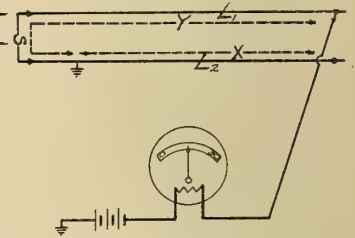


Fig. 20

well by reversing the operation, but it is a difficult proposition to determine the resistance of a cross between L_1 and L_2. Fortunately, however, a cross between the two wires of a line is usually of a low resistance, and it can safely be ignored in determining the location of it.

(to be continued)

Electric Railways

The Operation of Motor Buses

The question of the operation of motor buses in the city of New York was the cause of a report recently made on bus operation in London, Eng., and Paris. The report is by Mr. J. A. McCollum, assistant engineer of the Bureau of Franchises, and was submitted to Mayor Kline during the early part of November.

The report covers the situation in London and Paris pretty thoroughly but is not enthusiastic on the operation of motor buses in opposition to electric tramways. It is shown that the bus cuts into the earnings of the railways where they are allowed a free choice of route, but the operating costs are high and absorb a very large percentage of the gross earnings. Under the head of operating costs, figures are given on a system which covered over 1,250,000 miles in 1912 and where the total cost per car mile worked out to 14.264c. This was a London system. A Paris company has given out figures which show the average cost per car mile as 21.66c. The percentage of gross receipts required for operation seems to be in the neighborhood of 90 per cent. and in some cases is much higher than this. This, however, is offset by the smaller capital required to carry the same number of passengers which would be in the ratio of about 1 to 3. These cars cost anywhere from $2,500 each, if purchased in large quantities, up to $4,000 or more. The life of the motor bus has been estimated at 10 or 12 years but experience up to the present time has shown that the vehicle becomes obsolete after five or six years' use. When the design becomes more standardized this time may, however, be lengthened.

The number of fatal accidents caused by the motor bus is considerably greater than that caused by the tramcars for the same number of people carried, and the report states that "a very serious disproportion of fatalities caused by motor omnibuses is shown." Another objection to the buses is that the cost of maintaining the road bed is largely increased. The greater weight of the vehicles and the increased speed have been the cause of breaking up foundations which had naturally been laid to carry a lighter traffic. Mr. McCollum remarks that "New York should proceed slowly in permitting motor buses to operate on its streets and should be particularly careful in regulating the conditions of franchise and operation." The report closes with a summary discussion and comparison as follows:—

(1) The motor bus is independent of a large complicated system outside of the vehicle itself; it is itself a complete traffic unit.

(2) It can easily adapt its movements to street traffic.

(3) Not being confined to a fixed track, vehicles may run side by side, thus clearing dense traffic intersections much more rapidly than the surface electric railway cars.

(4) Routes may easily be changed, either temporarily or permanently—temporarily when there is obstruction due to fire, parades, etc.; permanently when desirable because of change of traffic conditions, making other routes more desirable to the travelling public, and without loss of investment in permanent street structures.

(5) Passengers entering or leaving buses may do so at the curb without risk of crossing dangerous street traffic.

(6) The breakdown of one vehicle in the street does not derange the service of other vehicles of the same system.

(7) Point to point speed somewhat exceeds that of the street car without exceeding maximum speed of the street car.

On the other hand, it may be said that the motor bus has also its disadvantages, when compared with the street surface car.

(1) It is a constant source of accidents. London statistics show it to be much more so than other fast-moving vehicles.

(2) The motor bus, because of its limited capacity, is unable to provide rush-hour facilities as effectively as the street car of larger capacity. (This is on the assumption that the weight and capacity of motor vehicles are rigidly limited, as in London.)

(3) The capacity of the motor bus being less than that of the street car, more moving vehicles in the street are necessary to do the same amount of work, thereby increasing the liability to accidents.

(4) When operated in large numbers, the motor bus will require more rigid regulation by the municipal authorities as to type of vehicle and method of operation.

(5) Less comfort to passengers, due to vibration. This vibration increases as the street surface becomes more uneven.

The report also adds the following suggestions:—

(1) Motor buses should be excluded from streets having macadam pavement and permitted only on pavement having a heavy foundation. The weight of the vehicle should not exceed that permitted by police regulation of London.

(2) Power should be retained by the franchise whereby the construction, size, power, etc., of the vehicle can be controlled, with the right to change any rules when experience shows that such change will be of benefit.

(3) Rate of fare should depend somewhat on distance travelled.

(4) No advertising signs should be permitted on the outside of omnibuses.

(5) Rate of speed should be limited, not by a maximum speed limit only, but in regard to dangerous or reckless driving as well.

(6) Upkeep of vehicles should be insisted upon with a penalty provided for failure to comply with rules in regard thereto, and thorough municipal inspection should be maintained.

London and South Western Railway Electrification

Work is just commencing on the electrification of the suburban lines of the London & South Western Railway Company. The generating plant will consist of six 5,000 kw., 3-phase, 1,500 r.p.m., 11,000 volt turbo-generator units. Power will be supplied at the generated voltage to nine substations by three-core cables which will be paper insulated,

lead sheathed and wire armoured and be carried on posts beside the line, circuits being so arranged as to afford a duplicate supply to all sub-stations. Each sub-station will contain transformers and rotary-converters for transforming to 600 volts d.c. The size of the converters will be, the larger 1875 and the smaller 1750 kw. The 600 volt current will be supplied to a third conductor rail which will be installed parallel to the line 16 inches from gauge and at such a height that the contact surface will be three inches above the rail level. This rail will be of special steel having a resistance about 6¾ times that of copper and weighing 100 lbs. per yard. It will be supported by insulators fixed to the sleepers and copper bonded. The current will be collected by cast steel collector shoes hung from the trucks. The running rails will of course form the return circuit and on these flexible copper bonds will be installed.

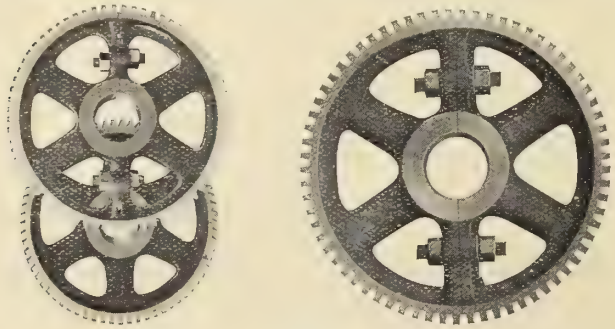
For the first section of the line 84 train units are being provided. Each unit will consist of three compartment type coaches and will be equipped with four motors each of 275 h.p. claimed to be the largest ever mounted on a passenger cab. A special motor truck carrying two of these motors will be fixed under each end of the train unit, the remaining trucks being of standard pattern. The control apparatus will be of the relay automatic multiple type provided for uniform acceleration and controlling, from the driving cab, all motors on a train of any length.

It is expected that the first section of this road will be in operation by the end of 1914. The electrical work is in charge of Mr. Herbert Jones the company's electrical engineer. The electrical equipment for the train units is being supplied by the British Westinghouse Electric & Manufacturing Company. The manager of the system is Mr. H. A. Walker.

Railway Six-Spoke Gears

A recent development in railway-motor gearing is the Nuttal design of a six-spoke cast-steel gear, which can be furnished either split or solid. This style of gear has six elliptical spokes instead of four ribbed spokes as in the older designs. The ribbed spoke has much thinner sections than any other part of the gear, causing unequal cooling of the casting in the mold with the consequent formation of shrinkage stresses and sometimes actual shrinkage cracks. The section of the elliptical spoke is practically the same as the rest of the casting, allowing a uniform rate of cooling and reducing internal stresses in the material to a minimum.

The six-spoke gear weighs from five to seven per cent. less than the old style gears of the same size and type. This



Six-spoke cast steel gears.

reduction in weight is largely due to the elimination of useless metal in the ribs and web. The new gear is somewhat lower in first cost and reduces operating expenses, as there is less dead weight to carry.

The six-spoke split gear has four 1¼-inch bolts, two on each side, about midway between the hub and rim. This gives ample rigidity and greatly facilitates assembling, as the nuts are readily accessible to any type of wrench. Stud bolts are used, the bolt being fitted into a tapped hole in one-half of the gear and held to the other half by a nut. The adjacent bolt is reversed, thus placing one nut on each side of the spoke and avoiding interference with wrench clearance by the nut of the other bolt. This method of bolting has been used for some time with complete success.

Cast-steel gears of this style can be furnished in any type and grade previously furnished in the old designs. Briefly the chief advantages of the new design are absence of shrinkage strains or cracks, greater solidity of metal throughout the casting giving added strength and reliability, lighter weight without sacrificing strength, lower cost, ease of assembly and uniformity of design throughout the entire range of sizes and types of gears.

The R. D. Nuttal Company, Pittsburgh, Pa., U.S.A., largest manufacturers of gears in the world, built the above mentioned gears.

An Inspection Pit Safety Device

The protection of employees has received a large amount of consideration in the Jersey City shops of the Hudson & Manhattan Railroad, which are in charge of P. V. See, superintendent of car equipment. One of the safety devices in use there is an automatic apparatus which replaces the time-honored practice of calling out in a more or less audible voice "Juice on car No. 732" before the current is put on a car. The new contrivance not only gives a clear warning whistle ten seconds before the current is put on the cars,

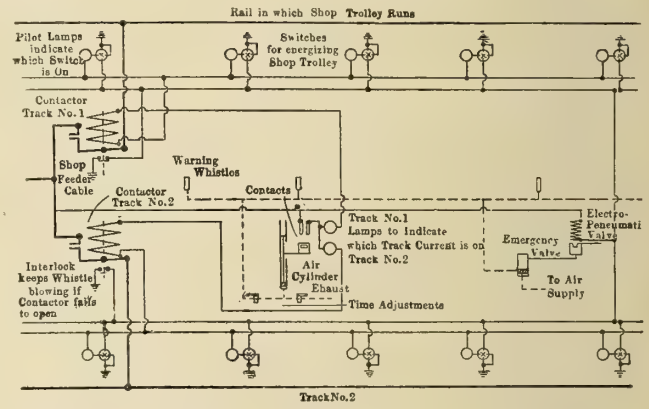


Diagram showing complete circuit of inspection pit safety device.

but it also keeps up this warning as long as the current remains on any of them.

The whistles used are high-pitched and of disagreeable sound quality. Hence they are more effective than an ordinary audible warning because their annoying and persistent character forces the repairmen to keep the current on the car no longer than absolutely necessary. Before the installation of this apparatus the current was often on the contact shoes for an hour or two at a time. Now the cars are not alive more than ten or fifteen minutes a day and usually about one minute at a time.

The apparatus consists of four Westinghouse air signal whistles which are equally placed throughout the length of the 400-ft. inspection pit, one electropneumatic valve, two contractors and one piston with contacts. The accompanying diagram shows the complete circuit. When a switchman desires to move a car he proceeds as follows:

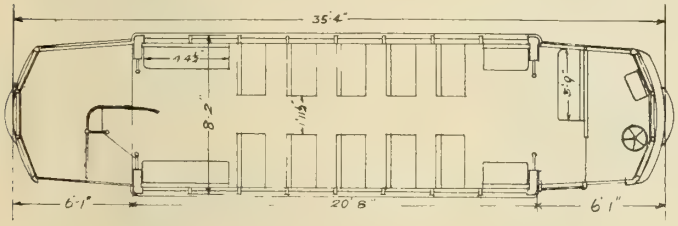
He first puts the Coburn trolley, which is dead, into the car and turns on one of the snap switches which are mounted on the wall, as illustrated. This switch has a double circuit, one point making a ground for the No. 1 or No. 2 contactor shown, depending on the side of the car-house. The same switch also completes the circuit for the magnets which

operate the air whistles, by grounding them. The whistles then start to blow.

On the air line with the whistles is a brass tube with piston which is connected to a heavy weight. A small adjustable leakage valve near this piston regulates the building up of the air-pressure in this line. As the pressure increases it raises the piston and weight. Four contact fingers are fastened on this weight. When the piston is raised to the top of its stroke it makes contact with two other fingers, thereby completing the circuit for the No. 1 or No. 2 contractor, picking it up and energizing the trolley. When the switchman turns off the snap switch the trolley removed from the car is no longer alive, and there is no possibility that the operator will receive a shock should the insulation on the cable be defective.—Electric Railway Journal.

New Cars for London

The London Street Railway Company are placing in operation a half-dozen single truck, single end, p. a. y. e. cars. The plan of the car is shown herewith. The overall length is 33 ft. 4 in.; the body 20 ft. 8 in.; the width over sheathing 8 ft. 2 in.; width of aisle 1 ft. 11½ in.; length of vestibule, both front and rear, 6 ft. 1 in. Each car has ten transverse seats, two longitudinal seats to accommodate two persons each, and two longitudinal seats placed at the rear of the car to accommodate three persons each. A seat to accommodate three has also been placed in the front vestibule backing the motorman.



Plan of London's new P. A. Y. E. cars.

The under framing is constructed entirely of steel the main members consisting of 3-16 inch plates 15 inches wide, one on each side of the car and reinforced at the bottom with an angle. Every effort has been made to give the frame strength to resist end or cross strains. The cars were built according to designs furnished by Mr. C. B. King, the general manager of the system who has made a special study of the requirements.

Toronto Railway Renewals

Considerable renewal work is being done by the Toronto Railway Company at various points throughout the city at the present time and the following notes will be of interest as indicating the system in use. By franchise agreement the roadbed is prepared by the municipality the company only placing the rails. Wooden blocks are now being used.

In order to form a solid bed the roadway is first excavoted to the depth of 22 inches. In the bottom of this excavation a 9-inch bed of concrete is laid. The concrete is mixed in the proportion of one part cement, two of sand and seven of stone. On top of this bed the cedar ties are laid which are 6 in. deep, and spaced from 2 ft. to 2½ ft. apart. These ties are held firmly in place by a second bed of concrete of the same consistency as the first one. This bed is the same depth as the ties, thus forming a level surface on which to lay the rails.

On the straight track there are two kinds of rail used depending upon the traffic to which they are subjected—one an 80 lb. T rail, No. 335, the other a 90 lb. girder rail, No. 392. On the curves where the stress where the stress is greatest a 108 lb. guard rail is used. These rails are manufactured by the Lorain Manufacturing Company, of Ohio. The rails are bonded at every joint by means of a bond constructed of copper strands and riveted to the rail at each end. In addition to these, intersection cables are used at the curves. These cables consist of four interconnected copper wires soldered to the four intersecting rails. Equalizing bonds are placed every thousand feet along the track.

When the rails have been laid and bonded the track is filled up level with the top of the rails by means of wooden blocks and the cracks poured full of asphalt. The blocks are so laid that they form a ½-in. arched surface.

When a portion of track is to be repaired the cars are deflected to one side by laying a temporary track the length of the part to be repaired. The track now used for this purpose is the Kerwin portable cross-over. This cross-over is very convenient as it can be quickly moved by means of a crane car. In cold weather when there is no danger of the track's sinking in the asphalt, track rods are placed on the asphalt and the track laid on these. In places where the pavement is arched the sidewalk side of the track is built up by means of planks. In warm weather the pavement must be covered with plank before the track rods are laid as the heat causes these rods to sink into the asphalt. This method of deflecting the cars along a temporary side track is much more satisfactory than the old way of sending the cars around another route as the temporary track can be left until the cement is thoroughly dry, and the cars still run on the same streets and schedule.

The Montreal Board of Control have referred to the city engineers the two schemes for underground subways submitted by the Montreal Tramways Company and the Canadian Autobus Company. Further details have been requested, and when these are received a board of engineers will be appointed to report on the plans.

The Montreal and Southern Counties Railway have let contracts for ten new cars, intended for their extensions. The cars will be of a slightly different type to those in general use on the system. They will be longer, the bodies higher, and with through platforms. They will be, however, of the multiple unit single control type. The contract for the bodies has been secured by the National Steel Car Company, Hamilton, while the Canadian Westinghouse Company will supply the electrical equipment, consisting of motors, air brakes and HL control apparatus.

The Court of Appeals, Montreal, have heard arguments in the case of the Montreal Tramways vs. the Quebec Public Utilities Commission. The latter ordered the company to give detailed information relative to the service, number of cars, earnings, lines, etc., and the directors declined to do so on the ground that the Commission had no jurisdiction. It was contended before the Court of Appeals that under the contracts with the various municipalities it is provided that any disputes or differences, or alleged failure on the part of either the company or the municipalities to fulfil the obligations, the Recorder's Court enjoys exclusive jurisdiction in dealing with such disputes. For the Public Utilities Commission it was argued that the Commission was exercising supervising and governing powers specially conferred upon it by the legislature, and it was thus constituted an extraordinary tribunal set up for purposes of public interest—which was superior to private interest. It was clearly intended that a simple contract between the company and a municipality should not over-ride the jurisdiction of the Commission. Judgment will be given later.

Illumination

Factory Illumination

The illustration herewith represents a direct lighting system recently installed in one of the service station plants of the Ford Motor Company. It may be taken for granted that this company would install the system calculated to give good illumination at the least possible cost. A corner



Fig. 1

of the factory is shown in Fig. 1. The system consists of silvered one-piece, glazed reflectors, each carrying one 100-watt clear bulb tungsten lamp. The station is divided into bays measuring 25 ft. x 28 ft., and in each of these bays four units are installed placed 11 ft. 6 in. from the floor and 12 ft. 6 in. and 14 ft. apart. These dimensions are shown in Figs. 2 and 3. The ceilings in this case are white and the floor is of concrete.

As stated above four 100-watt lamps are used to each bay, that is, 400 watts to 700 feet or an expenditure of .57 watts per square foot. The following figures are the results obtained from 19 photometric tests taken at points indicated by the small dots in Fig. 3. It will be noted that these tests are extremely uniform, ranging only between 3.96 and 4.25 foot-candles, with an average of 4.13.

Illumination Readings

Test Station No.	Foot-candles
1	4.18
2	4.10
3	4.16
4	4.13
5	3.96
6	4.20
7	4.07
8	4.20
9	4.25
10	4.21
11	4.19
12	4.00
13	4.21
14	4.22
15	4.03
16	4.15
17	4.07
18	4.07
19	4.15
Average	4.13

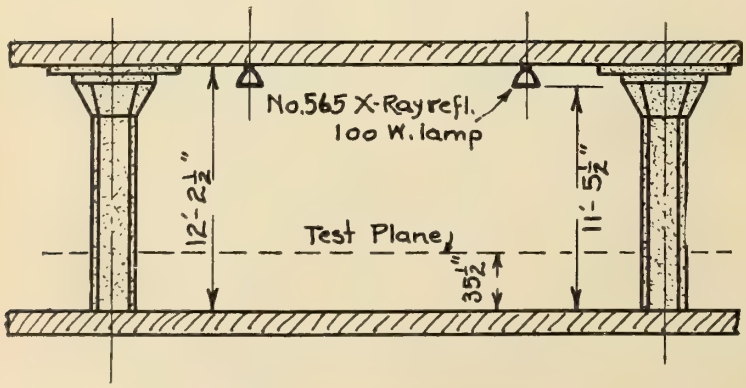


Fig. 2—Section of bay on 3rd floor.

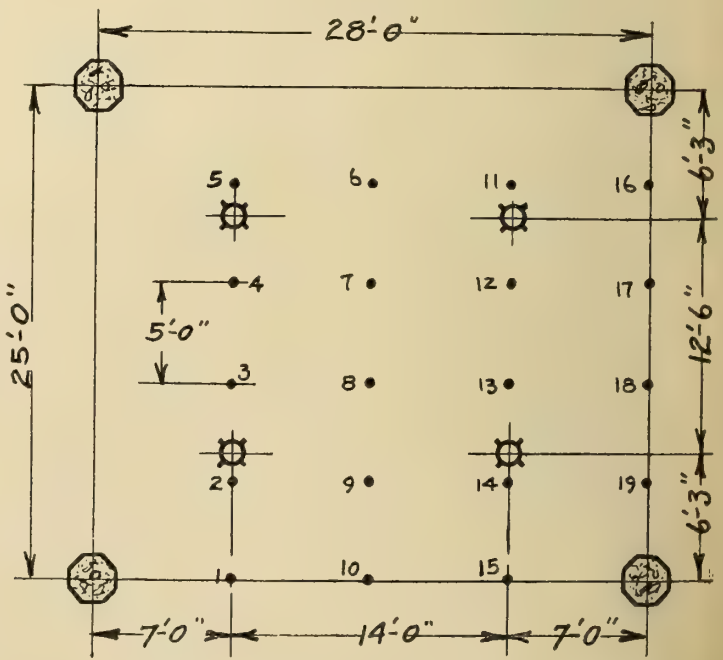


Fig. 3—Plan of bay.
Location of lamps and test stations marked.

The reflectors installed in this building are known as the beehive type and were supplied by the National X-ray Reflector Company. These reflectors, illustrated in Fig. 4, are made of glass, in one piece, with a coating of silver outside, which is protected by a green elastic enamel back-



Fig. 4

ing. The inner surface of the reflector is given a fire glaze which makes the cleaning process a simple matter, since it is only necessary to wipe out the reflector with a dry cloth.

Composite Street Lighting

The diagram shown in Fig. 1 represents a complex lighting service circuit operating in Wilkinsburg, Pa., and described in a current issue of Lighting Journal by Mr. Geo. W. Roosa, of the Westinghouse Company. This system is an admirable example of the flexibility of modern street lighting units, for not only have they installed lamps of various current ratings on the same circuit but also arc lamps and tungsten lamps of different candle power. As indicated in Fig. 1, the circuit contains a number of 80 c.p. 7.5 ammeter tungstens, a number of 200 c.p. 7.5 ammeter tungstens and a num-

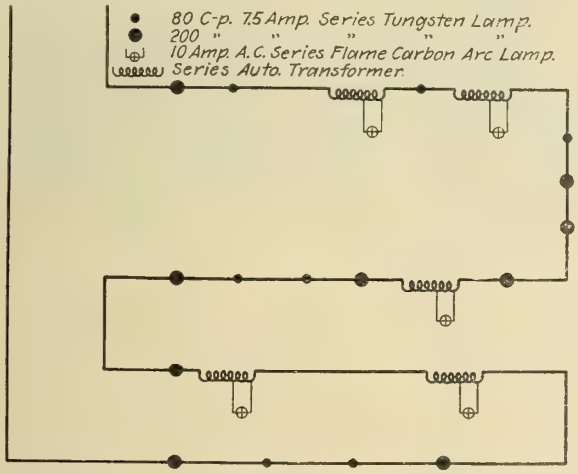


Diagram of complex series circuit containing 10 ampere flame carbon arc lamps, 7.5 amp., 80 c.p. and 75 amp. 200 c.p. street series tungstens

ber of 10 ammeter a.c. series flame carbon arcs. To adapt the ten-ammeter arc lamps to the 7.5 ammeter circuit, as required by the tungstens, series auto-transformers were inserted above each arc lamp as shown in the figure. In some cases the auto-transformer has been mounted on the mast arm or even at the pole instead of directly above the lamps which gives additional height to the lamp and decreases the weight of the apparatus on the end of the mast arm. It is the intention of the lighting company to place all auto-transformers at the pole eventually, as, in addition, the lamp-man can attend to the lamps while the line is alive as he can short circuit the secondary of the auto-transformer and cut the lamp completely from the line.

The article states that this system has been found most advantageous in Wilkinsburg as different types of lamp are required at different points. At street corners where there are no trees the arcs are used; on hilly streets or where foliage is low and thick the tungsten lamps placed closer together give much better results.

Combination Railway and Light Poles

The city of Niagara Falls, New York, has just completed the installation of a number of combination railway and lighting poles. The poles are of 7 in., 6 in., and 5 in. standard weight tubing and present a very handsome appearance. These poles have all been provided with a slot below the ground level so that if at any time in the future it is decided to run wires underground these can be removed from the top of the poles where they are now placed and run in conduit below the sidewalk level and up the poles with a minimum of expense. In the brackets used on these poles provision has been made to take positive cutout. It is not



A view of Niagara Falls Main Street

necessary to remove any portion of this bracket to operate the cutout as a small chain and ring extending below the bracket are provided for this purpose.

The poles for this installation were supplied by the Electric Railway Equipment Company. The lamps used throughout are the General Electric magnetite type. There are 112 poles complete making a total of 224 lamps.

The villages of Bolton, Thistledown and Woodbridge are at present agitating for electric energy and the Hydro-electric Power Commission of Ontario have already submitted a system covering Bolton and Woodbridge. The rate is understood to be in the neighborhood of $44.00 at distribution voltage. It is suggested that the distribution could be made from the Weston sub-station.

The Dealer and Contractor

The Wiring and Illumination of Freight Sheds

The Canadian Pacific Railway Company have just completed their new freight sheds, said to be the largest in Canada, on the corner of King and Simcoe streets, Toronto, of which the illumination forms a very important feature as these buildings are in use practically twenty-four hours every day. The buildings consist of an "inbound" shed approximately 900 feet long by 50 feet wide; a transfer platform 900 feet long, and an "outbound" shed approximately 900 feet by 30 feet. A small part of a horizontal section through these sheds, shown in Fig. 1, will represent their relative location and also the location of the lighting units and the different outlets.

The inbound shed consists of bays, 15 ft. x 50 ft., as shown in Fig. 1. It is lighted by suspended units, 60 watts each, with 14-inch flat porcelain reflectors placed as indicated by the circles in the drawing. There is a second storey to the inbound shed, but in this storey only two lamps are used in each bay, the arrangement being as shown in Fig. 1 in the outbound shed. Three lines of cars may be drawn up between the inbound shed and the transfer platform, and three lines between the platform and the outbound shed. These cars can be lighted by portable lamps, enclosed in wire guards, and having a sufficient length of flexible cord to reach to the nearest side pillars of the inbound shed, on the one side, and the nearest side pillars of the outbound shed on the other side, where push type receptacles have been installed.

The transfer platform also uses 60-watt lamps with the same type of flat porcelain reflectors. In this case, however,

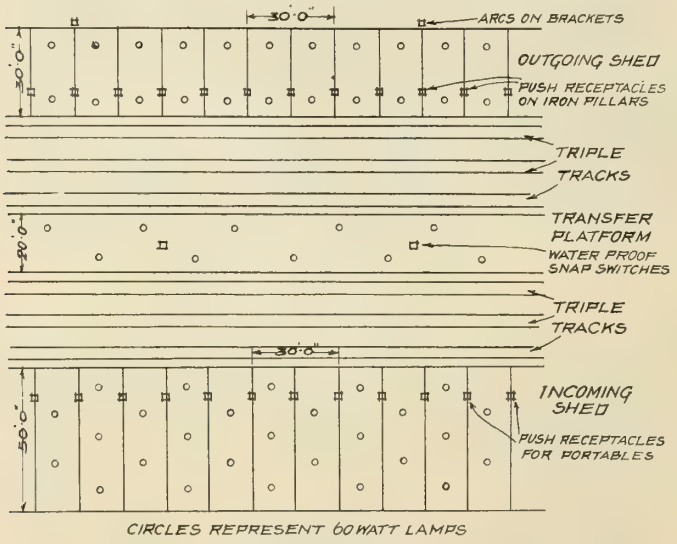


Fig. 1—Plan of sheds.

each lamp is supplied with a shock absorber and is protected by a wire basket. As seen in the drawing the lamps are staggered. 112 lamps are used on this platform, 56 on each side.

The outbound shed consists of bays approximately 30 ft. x 15 ft. and two 60-watt lamps with flat porcelain reflectors are used in each bay as shown. As already explained each pillar on the side next the transfer platform is supplied with a push receptacle so that portable lamps for lighting the cars may be attached.

The wiring throughout is contained in conduit and the shed circuits are controlled in sections from enclosed wall panels placed at convenient points. The arrangement of the transfer platform is somewhat different, its illumination being controlled from snap switches placed at intervals along the platform. These are a weather-proof type, being a combination condulet and snap switch.



Fig. 2—Office lighting.

The sheds are equipped with an intercommunicating telephone system of Northern Electric telephones and a 15-station magneto watchman's clock system manufactured by Munderloh & Company is being put in.

The office lighting is practically uniform, and consists of single chain pendants, each chain carrying a 60-watt lamp surmounted by an Alba shade. The chains are in statuary bronze finish. The photograph shown in Fig. 2 is typical of the installations throughout the offices.

The main switchboard, which is placed in the basement, consists of a single marble panel on which are placed separate three-pole switches for each shed, for the office buildings and for electric water heaters placed in the different toilets. The board also has two ammeters, a volt meter and the Toronto Electric Light Company's wattmeters. The wiring in the office building is also done in conduit but the work is all concealed. In addition to the lighting already explained a number of AB flaming arcs are being installed at different points in the yard north of the outbound shed. A number of these will be placed on brackets outside the outbound shed and between the doorways. Others will be placed on posts so as to light the yards.

The conduit throughout this installation was supplied by

the Conduits Company, Limited; the reflectors by the Benjamin Electric Company; condulets, weather-proof switches and panel boards by the Crouse-Hinds Company; outlet boxes by Thomas & Betts and the Electrical Fittings Company; the brackets and posts for the arc lamps by the Cutter Company; the push switches in the office are Bryant-Perkins type; the wire was supplied by the Imperial Wire & Cable Co.

The electrical equipment of the sheds and offices has been installed throughout by the firm of Harry Alexander, the same firm which carried out the contract for the new Bank of Toronto building, Toronto.

Business-Getting Pointers for Electrical Contractors

By G. E. Shepherd, E. E.

We have all heard it said that the electrical contractor is neither a good merchant nor a good business man. It is not the purpose of this article to enter into a discussion of the merits or demerits of either of these statements. Both are interesting and pertinent and might be taken up with profit to us all. Of the two subjects, however, the one which directly concerns every electrical contractor is that which has to do with the obtaining of new work and the best means of going about it. Just a few thoughts, suggested by a somewhat varied experience covering many years in this particular field, may supply an idea to some and, therefore, be worth while.

To start at the very beginning, a thorough working knowledge of the business is essential. Possessing it, there follows that confidence and assurance, which is another way of saying belief in ourselves, which guarantees success and without which many other qualifications frequently produce only failure.

We must be honest, not alone with ourselves, but with all with whom our business brings us into contact. On this there can be no compromise. A man is known in his community, and his ideas and opinions respected, very largely by reason of his integrity and the knowledge of his work which he is known to possess. Having these things, it follows that his credit stands high and at once his business acquires a reputation for honesty and square dealing which is its very backbone and life. It will carry him through crises where his competitor, not so well esteemed, falls by the wayside.

In this is found the explanation, so difficult for some of us to understand, why one man seems so successful in going after new work, or in interviewing the manager of the central station in his home town, whereas, with seemingly equal energy and an equal knowledge of his work, the other man so frequently fails.

After a few experiences of this kind, the unsuccessful contractor often concludes it must be a question of price and proceeds to cut still further into the already too meagre profits which he so frequently figures. He hasn't realized that he is on the wrong track and is getting still further away from the goal he is striving to reach.

Assuming, however, that our friend has made none of these mistakes, that he has a thorough knowledge of his business, that his ideas of business honor and personal integrity are high, that he is industrious—in short, has all these desirable and necessary qualifications—how shall he go about it to increase the number of contracts on his books?

He has of course taken care to provide a thorough system of accounts. He has a good bookkeeper or has ensured that all records and accounts are promptly and accurately kept. His charges are regularly entered and bills sent out promptly. In short, he is prepared to satisfy any customer making a complaint that he has used all due care in handling his business.

He advertises in his home papers. He does good work only and employs the best mechanics obtainable. The public knows this. He is constantly telling them so and they naturally come to believe it. And here is where your real work begins. When a job is placed in your hands, follow it up—personally, if you can. The interest you manifest in your work is seen to follow the award of the job to you and you follow it through to the finish. You are particular with your work. The public notes that you are not satisfied with a fair job. You are always asking that your workmen turn it out just a little better than your customer expects—and, of course, better than your competitor. You have, in short, built up a reputation for yourself. You find, as did the writer on one occasion, a customer coming to you and saying, "I would like you to wire my building. Tell me what it will cost, but I want you to do it in any case. I am told you will charge me somewhat more than the other fellow, but you are particular with your work and the job will be done right. I like my work done that way and I realize you can't get the best things for the lowest price." And so you have by earnestness of purpose, honesty and square dealing and a thorough knowledge of your work, built up that most valuable of all assets in a successful business, and one which can not be bought—a good name and a good reputation.

Join the associations of your fellow electrical workers. Form a local association in your home town if you have none. Meet and form an intimate acquaintance with all the electrical men in your vicinity. Affiliate with your local civic bodies—your Board of Trade or Chamber of Commerce. Speak up and assert yourself in their deliberations; make yourself well known in your community. Is there a good club in your town? Join it. Meet in a social way in the evening the men who will be the more ready because of the association to give you their business in the office the next morning.

Join the National Electrical Contractors Association. It is the Court of Last Resort in your particular field. Do you share, pay your way; don't keep outside such a splendid organization, refusing your support and yet daily reaping the fruits of the unselfish work of those who constitute its membership.

You won't do it if you are honest with yourself. You have seen that you can't succeed as a business getter if you are a piker. Be liberal, therefore, not only in your views, but with your fellow-workers. Do these things and do them well and satisfaction and success shall be your reward.

—The National Electrical Contractor.

Rico Coasting Time Recorders

A coasting time recorder, an instrument that records the actual number of minutes that an electric car or train is operated without the use of power or brakes, is being placed on the market by the Westinghouse Electric & Mfg. Co. It is an efficient and desirable device to secure greater economy in operating railway equipments. It reads in "coasting minutes," delivering a printed voucher-slip to the motorman at the end of each run. This voucher-slip shows the degree of economy which the motorman has exercised on every run. By a system of ranking or rewards, the railroad company may make a practical and monetary inducement to the men for economical operation, and thus greatly reduce the amount of current ordinarily used in the propulsion of electric cars. Its purpose is to make a motorman substitute brains for sheer muscle.

This device provides an accurate and consistent means of obtaining a record of the amount of coasting secured in the operation of electric railway equipments. The energy input to a car is utilized to overcome the resistor losses in starting, to overcome the losses in the motors and wiring, to impart velocity to the car, and to overcome friction. By far

the larger part of the energy for a service with frequent stops is that required to impart velocity to the car. The momentum thus imparted will keep the car in motion without additional energy if the power is shut off and the car allowed to coast to a complete standstill. Although coasting to a standstill is not practicable for the accomplishment of reasonable schedule service, improvement in economy of current consumption can be effected by the nearest permissible approach to the above condition. The greater the amount of coasting on any given schedule, the less total energy expended for its accomplishment.

The coasting recorder is a simple and reliable automatic device which effectively puts an automatic and impartial check upon each man at all times. It records in coasting minutes, and its object and method of operation are readily understood by the motorman, who soon becomes not only alert in its use but enthusiastic in the support of operation which is increasing his efficiency and actually his earning power. The coasting recorder is an efficient guide for the motorman to operate properly. It provides a continuous check on his operation for each trip.

Attaching Conduit to Cement Ceiling

In our December 1 issue we published a complete description of the installation of exposed conduit wiring in a large factory, one of the most interesting features in which was the method adopted of attaching conduits to the concrete ceiling. The illustrations herewith show other methods that have been employed recently and described in a current issue of the Electrical Review.

Fig. 1 shows how the work was done when a long run consisting of a number of parallel pipes was to be carried along close to the concrete surface. Standard iron expansion cases—which can be bought from any one of several manufacturers—were used to fasten light channel irons to the ceiling, the length of the channel iron being placed at right angles to the direction of the conduit run, and to these pipe clamps for the conduits were fastened in the manner shown in the figure.

The expansion case referred to above consists of a sort of hollow split cylinder, whose two halves are held together at the end which will be nearest the surface of the ceiling when the device has been installed by a narrow band of rather elastic metal. The opening along the centre of the

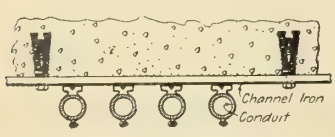


Fig. 1.

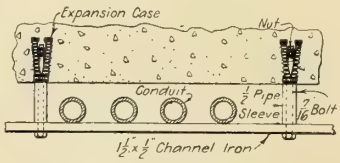


Fig. 2.

cylinder is one that gets larger as the end is approached, so that when a bolt is thrust through the expansion case from the opposite end a nut can be placed on the end of it and pulled slightly down into the expansion case without spreading the sides of the case apart. If thereafter the bolt is turned in such a manner as to draw the nut down into the hollow expansion cylinder, the walls of the latter are flared apart.

Fig. 2 illustrates the construction employed where the conduits have to be suspended below the ceiling so as to pass below other work, or for any other reason. Here, longer bolts, slipped through pieces of pipe, are made use of to support the cross pieces of channel iron on top of which the conduits rest.

The Hall Switch and Signal Company, of Montreal, have been awarded the contract for the equipment for train despatching by telephone on the Intercolonial Railway between St. John and Moncton, N.B.

Cooking By Electricity

Electricity as a safe, clean and easily controlled heat source offers numerous advantages when employed for cooking purposes, and with the advent of cheap electrical energy, cooking by electricity is certain to become more general.

For household cooking the complete electric range is doubtless the most convenient and satisfactory. Separate heated utensils have their advantage of course, and in many cases are indispensible, but the housewife or the cook appreciates the electric range with its oven, its broiler and its hot plates, which enable her to perform the operation of cooking in the accustomed manner and with the ordinary utensils.

The product of the electric oven is generally conceded



Fig. 1.

to be much superior to that of gas or other stoves. This is largely, no doubt, due (1) to the fact that in the electric stove the moisture is retained in the food; (2) neither is there the same danger of extremely hot temperatures which often result in burning, as the control of the temperature in an electric stove is much simpler; (3) the healthfulness of the electric stove as compared with others using gas or coal is also a very large factor in favor of the electric; (4) from the point of view of cleanliness also the electric is much superior; (5) the cost of operation which has always been the argument used against electric stoves will be seen from figures that follow to compare very favorably with the operation of gas stoves. Companies are now getting into the habit of giving a special rate for cooking, but even without this concession it is safe to say that the electric stove is now in a position to hold its own with the other kinds.

The new type "R" range which is being placed on the market by the Canadian General Electric Company as illustrated herewith contains many distinctive features of design and workmanship. The design supercedes their D 40 Domestic range and embodies the results of extended research and practical experience with special reference to more efficient heat storage and ventilation.

The encased wire design of heating element which is

used in all devices of this range, provides improved thermal contact between the unit and the working surface, while its small mass insures a minimum heat lag. The result is, quick heating and high efficiency. Higher temperatures than are possible with mica insulation can also be obtained.

The economy in cost of operation of the range is a noteworthy feature. Representative menus for four and five persons have been prepared at a total monthly cost of $3.00 with electricity at 3c per kw.hr. The connected load is reduced from 6 kw. or more (as in many former ranges) to 3.6 kw. For the representative menus the maximum demand was 2.85 kw. and the average daily consumption was 3.28 kw.h.

This range combines practicability with artistic outlines and attractive appearance. All exposed surfaces will have

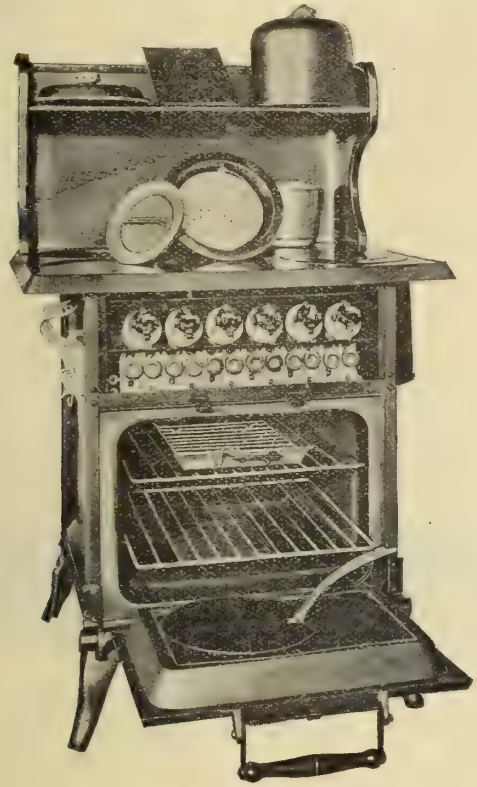


Fig. 2.

a blued steel finish which resembles gun metal, is durable and easily maintained.

Some of the important innovations not previously referred to are noted below:—

Encased wire heating units.

Thermally insulated cooking compartments.

Steam-proof casings inside oven and cooking compartments which have rounded corners to promote cleanliness.

Thermally insulated stoves.

Non-rusting metal throughout.

Some Actual Figures

Before placing this range on the market, the company have tested it out in practical cooking operations under many different conditions and some of the figures obtained are given herewith. The dinners would appear to be rather above the average in size and sufficient in many cases for 10 or 12 persons. The full day, however, may be fairly taken to be representative of the average family needs.

The average maximum demand of a range when preparing these meals was 2.85 kw. while with six different ranges the resultant maximum demand was only 9.6 kw. instead of 17.1 kw. (6 × 2.85) thus showing a diversity factor of 56 per cent.

Menu No. 1 For Average Family

Breakfast	Amount	Mins.	Watt-hr.	Total Watt-hr.
Corn Flakes				
Fried Eggs	5 eggs	6	114	
Toast	8 slices	11	112	
Coffee	1 qt.	18	140	366
Dinner				
Roast Beef	6 lbs.	135	1925	
Mashed Potatoes	2 lbs.	63	203	
Backed Macaroni	½ lb.	30	486	
Caramel Pudding		20	345	
Coffe	1 qt.	16	126	3085
Supper				
Creamed Codfish			88	
Pop Overs	12	44	764	
Preserves				
Tea	1 qt.	10	178	1030
		Total		4481

Menu No. 2 For Average Family

Breakfast	Amount	Mins.	Watt-hr.	Total Watt-hr.
Oatmeal	1½ pt.	38	192	
Meat on Toast		5	90	
Toast	10 slices	15	162	
Coffee	1 qt.	18	137	581
Dinner				
Soup	1 qt.	15	180	
Steak-broiled	3 lbs.	35	607	
Steamed Potatoes	2 lbs.	64	242	
Vegetable Salad				
Suet Pudding	10 individual	65	191	
Coffee	1 qt.	18	128	1348
Supper				
Beef warmed up		6½	96	
Boiled Potatoes	2 lbs.	53	273	
Bread				
Tea	1 qt.	8	139	
Cake	1½ lbs.	54	436	934
		Total		2875

Menu No. 3 For Average Family

Breakfast	Amount	Mins.	Watt-hr.	Total Watt-hr.
Corn Flakes				
Fried Bacon	½ lb.	11	188	
Fried Eggs	5 eggs			
Muffins		44	620	
Coffee	1 qt.	18½	140	948
Dinner				
Lamb Chops	10	11	276	
Creamed Potatoes	2 lbs.	12	167	
Green Peas	2 cups	11	71	
Apple Pie	2 pies	60	768	
Coffee	1 qt.	18	142	1424
Supper				
Baked Beans	2 cans	30	93	
Toast	10 slices	14½	155	
Sauce				
Tea	1 qt.	12½	212	460
Cake				
		Total		2832

The Canadian Pacific Railway Company have awarded a contract for the construction of their tunnel through Roger's Pass to McIlwel & Sons, Denver. The work is to commence on January 1 and be completed within three years from that date.

Why I Need an Electric Sign

Because advertising is an investment and not an expenditure.

Because electric advertising is conceded to be the most judicious and practical of all advertising.

Because this is an age of electricity.

Because an electric sign tells who I am, what I sell, and where I am.

Because the best advertising experts in the world recognize the value of the electric signs and rank them higher than any other advertising display.

Because the most successful and wisest merchants in the land use electric signs.

Because this is an age of individualism.

Because persons on the street see ahead and not cross-eyed, so that my nameboard over the door and even my elegant windows may not be noticed by 90 per cent. of the passers-by.

Because an extended sign is viewed at a distance and by its psychological "power of suggestion" may create a demand from an old customer or bring me a new one.

Because an electric sign is the best insurance against business decay.

Because it shows I am not a "back number"; but that I am in line with progress and in the band-wagon every minute.

Because people naturally seek the bright places and an electric sign will make my store more attractive.

Because an electric sign works for me night and day, and unlike other forms of advertising, has an unlimited circulation.

Because more than one business has been pulled out of the rut by an electric sign.

Because I am losing money every day that I don't get an electric sign.

Because I will have to get an electric sign sooner or later and "there is no time like the present."

Because I want to be a leader. Let others follow if they will, but I prefer to get my sign up first and not be forced later on to recognize "the other fellow's" business acumen and good sense.

Because I don't keep open nights is no reason at all why I shouldn't buy a sign. Neither do banks, department stores, and many other businesses remain open evenings, and in every locality they use Electric Signs; that is in every locality that teems with business and is prosperous.

Because spasmodic, occasional, "once-in-awhile" newspaper or circular advertising has only temporary, fleeting advantages and in the long run costs many times the maintenance of a sign. The time to advertise is all the time, and only an electric sign does this.

Because its advertising influence is greatest and can not be escaped, at a time when the mind of the average person is in a receptive mood; and the public takes in advertising devices that are absolutely unnoticed in the ordinary rush of the business day.

Because even if I have been established in business "so long that everybody knows me," I recognize the falsity of that foolish conceit, for I know that new families move into my town, young people grow up, and their parents' allegiance to me may mean nothing to them.

Because an electric sign is a permanent improvement to my "front," one that will give me a great advantage over my competitor. The cost of a sign melts into insignificance when I figure it is good for ten or twenty years.—Electric Sign Journal.

The Birmingham city council has decided to grant the free use of electric cars of the city to blind persons. The estimated maximum revenue loss to the city is $500 per annum.

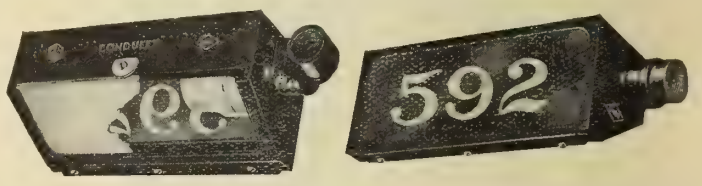
Continued Use of Old Code Wire

A matter of general interest to electrical contractors has been brought to our attention during the past week, with reference to the continued use of old code wire. The requirements of the code should by this time have been sufficiently advertised that no one can plead ignorance. One electrical contractor will be out considerably in his calculations as the result of his failure to meet the requirements, and we print the following item, received from one of our correspondents, for the guidance of any others who may be thinking of following similar practices. Though the hardship is evident, so is, also, the justice of the action of the Underwriters' Association.

"One of the representatives of the fire insurance interests of Western Canada recently had occasion to examine the electric installations in two buildings being erected for the Canadian Bank of Commerce in the west. The bank authorities called for the Underwriters' certificate of acceptance of the wiring and when their inspector visited the buildings in question, he found that old code wire had been used in both installations and that the specifications called for new code wire. The local contractor tried to get around this by endeavoring to show that in his home town the use of old code wire was still permitted. Under the circumstances, however, the Underwriters' inspector had to turn the job down and, his action being fully upheld by the bank authorities, both buildings had to be rewired from top to bottom."

House-Number Condulet

The illustrations herewith represent a new type of condulet being placed on the market by the Crouse-Hinds Company and known as the "house-number" condulet. These condulets show the house number and, when properly located, the lamp will also illuminate the steps and door. Two



styles of separable swivel hubs are made, one straight and the other a 90 deg. hub, which are interchangeable on any of the company's condulets. The front glass can be furnished with any number of letters desired, not exceeding five characters. Any incandescent lamp with dimensions not exceeding 2½ x 4⅝ inches can be used.

New Publications

The Westinghouse Electric & Manufacturing Company have just issued a number of pamphlets covering railway line material. Catalogue section DS840 covers suspensions, ears and splicers. Different types of trolley suspensions are illustrated and described therein; and also various accessories such as expansion bolts, insulators, clinch ears, trolley splicers, strain ears, wire chucks, etc., are listed and illustrated in a convenient manner.

Section DS841 covers frogs, crossings, section insulators, switches and lightning arresters. The well-known Detroit trolley frog and other types are fully described and illustrated; also the different types of trolley crossings, both rigid and adjustable. In the lightning arrester section, pole type lightning arresters, together with fittings such as ground plate, ground point and cap, grounding bonds, etc., are fully described, together with the proper method of making ground.

Section DS844 covers strain insulators of various types and for different kinds of service.

Section DS850 covers rail bonds and bonding tools. This pamphlet gives in some detail the methods of manufacture of rail bonds, and also some carefully prepared information

on the selection of rail bonds. Tables are given showing the net weight in pounds per hundred bonds, and installation views of different types of bonds are shown. Rail bonding tools such as ratchet drills, facing tools, bonding punch, bond compressor, etc., are also described and illustrated. There is also given an illustrated description of portable grinders, torches and clamps.

Uni-Set Combination Devices

A relatively inexpensive means of adapting electric table cooking on a more or less extensive scale is provided by the various combinations of the Uni-Set devices as manufactured by the Canadian General Electric Company, Limited. You can have an electric stove, chafing dish, coffee percolator, tea samovar, egg boiler, baby milk warmer and cereal cooker by buying the complete set. In so doing you save the price of three electric stoves as one Uni-Set stove serves for all of these parts or "units." On the other hand, if you can't afford a complete set you can buy, for example, a Uni-Set chafing dish or a coffee pot to start with and gradually add to it by buying the other Uni-Set parts or "units"—that is, the devices less the stove.

Larger Quarters for the J-M Company

The Toronto branch of The Canadian H. W. Johns-Manville Company, Limited, announces removal to more spacious quarters at No. 19 Front street east. This new store and warehouse has a floor area of approximately 35,000 sq. ft. and is situated in the heart of the wholesale district. In their new quarters this firm will be able to carry a larger stock and have ample space for the display of their complete line of J-M asbestos roofings, packings, pipe coverings, building materials, electrical and railroad supplies, automobile and plumbing specialties, etc. The entire building will be lighted by their well-known Frink and J-M linolite system of lighting and one room will be used for exhibiting these systems of lighting.

J. D. Lachapelle & Company

Mr. J. D. Lachapelle has severed his connection with R. E. T. Pringle and will continue the business of engineers and manufacturers' agents under the name of J. D. Lachapelle & Company. His offices will be at 519 Canadian Express Building, Montreal. The new company will represent, in Canada, among others, the C. & C. Electric and Manufacturing Company, the Detroit Hoist and Machine Company, the Oil, Motor and Manufacturing Company, and will also deal in arc lamps, electric drills, reamers, storage batteries, and ornamental street lighting standards. Mr. Lachapelle is well known in the Canadian electrical field with which he has been connected for some twenty years, much of which time has been spent in connection with electrical installations of many kinds in industrial work.

Hamilton Section C.E.A.

The annual meeting of the Hamilton Electric Light & Power Company section of the C. E. A. was held in their meeting rooms at the Terminal Station, Hamilton, on Thursday, December 4th. A paper from the Electric Bureau of the N. E. L. A. on "The Evolution of the Transformer" illustrated with lantern slides was presented by Mr. W. Dorland. A social programme followed, Mr. W. E. Goring presiding at the piano very acceptably. The following officers were elected:—Honorary president, Mr. Wm. C. Hawkins; honorary vice-president, Mr. E. P. Coleman; president, Mr. W. Dorland; vice-president, Mr. Geo. D. Fearman; secretary-treasurer, Mr. Geo. H. Goring; executive committee, Messrs. L. W. Pratt, Hugh Lennox, W. G. Angus, and C. H. Fry.

Automatic Telephones

The British Postmaster General has announced that after a fairly exhaustive test the Postal Department of the United Kingdom purposes spending $500,000 in establishing further automatic telephone exchanges. The announcement states that while the telephonic service in America is more efficient than in England at present, it is not so efficient as theirs will be eventually.

New Companies

The Alberta Hydro-electric Company, Limited, has been incorporated, with head office at Calgary.

The Lachine Rapids Power Company has been incorporated with head office at Montreal.

The Vaudreuil Electric Company has been incorporated with a capital stock of $50,000.

Trade Publications

Telephone Selector.—A booklet issued by the General Railway Company illustrating and describing the equipment used in their selector system.

The Auto-Electric-Cook:—A catalogue just off the press and being distributed by the Automatic Electric Cook Company, Limited, of Toronto, introducing the Auto-Electric-Cook Stove, which is stated to be a most economical servant, an automatic cook, and an ideally perfect stove.

Industrial Lighting.—Bulletin 20 issued by the Engineering Department of the National Illumination Works of the General Electric Company containing much useful information on the requirements of good illumination in industrial plants.

Condulet Pocket Reference.—A booklet issued by the Crouse-Hinds Company of Canada, similar to their original pocket reference on the subject of Condulets but containing much new information on additional types of equipment now being placed on the market by this company. The booklet is of a size that can be conveniently carried in the pocket, is well illustrated, and contains much useful information on the subject of electric fittings.

Household Appliances.—Catalogue No. 18 issued by the Simplex Electric Heating Company, Cambridge, Mass., describing and illustrating their electric heating appliances for cooking and miscellaneous purposes. The Canadian branch of this company is in Belleville.

Hydro-electric Power Developments.—Bulletin No. 4966A issued by the Canadian Allis-Chalmers Company, Limited, describes a few of the hydro-electric plants installed in recent years in which Canadian General Electric and General Electric units have been used. The booklet is illustrated with photographs of some of the more famous generating stations in America.

Boilers.—Bulletin No. 6 issued by the International Engineering Works, Limited, describing Robb water tube boilers. The bulletin is well illustrated and contains useful information on the operation of this equipment.

Single Phase Converter.—Bulletin No. 103 issued, in miniature, by the Wagner Electric & Manufacturing Company, describing, with illustrations, their single-phase converter used for changing alternating current to direct current, for such purposes as lantern work, battery charging, X-ray work and driving d.c. motors for general applications.

If your Electrical News does not reach you promptly, kindly advise our Subscription Department without delay.

Current News and Notes

Amherst, N.S.

Negotiations are proceeding between the Canada Electric Company and the town council regarding improvements in the street lighting system.

Barrieville, Ont.

The wireless apparatus to equip the new Marconi station at this point has arrived and the generating equipment is expected in a few days. It is believed this plant will be operating early in the new year.

Brockville, Ont.

At a recent sitting of the Ontario Railway and Municipal Board, held in Brockville, Chairman McIntyre, heard deputations from the Athens, Plum Hollow and Eloida Rural Telephone Company and the Mallorytown and Lyn Company, who make applications to have the two lines connected. An order was made granting the request. When the order is carried out it will mean the last link in the chain connecting the trunk lines of the different rural telephone companies doing business in Leeds and Grenville.

Brandon, Man.

Mr. C. Chamberlain met the Brandon city councillors at a special meeting on November 19, and outlined a proposition to bring power to this city from Silver Falls. The following prices were mentioned:—1,000 h.p., at $40 per h.p. per annum; 1,250, at $39; 1,500, at $38; 1,750, at $37; 2,000, at $36; 2,250, at $35; 2,500, at $34; and so on down to 3,500 h.p. for $30.

Beausejour, Man.

A by-law was recently passed authorizing the expenditure of $3,000 on an electric light system.

Chatham, Ont.

Negotiations are in progress between the city council and the Chatham Gas Company regarding the purchase of the property of the company to be operated municipally.

Courtright, Ont.

The installation of a municipal electric lighting plant has been suggested. Also a proposition has been made by a private party to install a gasoline electric plant for the purpose of lighting the town.

Cornwall, Ont.

Canadian Cottons, Limited, have just started up a 625 kw., 2200 volt, 3-phase, 60-cycle, 275 r.p.m. Swedish General Electric generator, supplied by Messrs. Kilmer, Pullen & Buriham. This is replacing water and steam drive which up to the present time has been used generally for motive power in this plant. The new generator is driven from the turbines already installed and is connected to them by a rope drive. A 10 kw. exciter is driven from the generator shaft by a Reynold silent chain. Some twenty Swedish motors have also been installed at different points in the plant. These vary in size from 25 h.p. down. These are in addition to a number of old motors which have been operating for some time on current purchased from the St. Lawrence Power Company.

Collingwood, Ont.

The town has closed a contract with the Imperial Steel & Wire Company to supply electric energy to the latter to the extent of 350 h.p. This brings the consumption of electric power in Collingwood to over 700 h.p. Power is purchased by the town from the Hydro-electric Power Commission of Ontario who transmit from Severn River.

Dalhousie, N.S.

The municipal electric light plant was placed in operation on December 1. This plant consists of a producer gas unit, an engine, and 75 kw. generator supplied by the Canadian General Electric Company and installed under the supervision of Chipman & Power, engineers.

Davidson, Sask.

This town has installed a producer-gas electric plant for supplying light and power. The equipment consists of a producer plant having a capacity of 125 h.p., a 3-cylinder, vertical, producer-gas engine of 80 h.p. capacity and a direct connected 75 kv.a. generator. The producer plant and engine are being supplied by the Canadian Producer & Gas Engine Company, Barrie, Ont., and the generator by the Canadian Westinghouse Company.

Fernie, B.C.

The city of Fernie expects to purchase within the next seven months an automatic voltage regulator for four-wire, two-phase, 60-cycle, 2400-volt current for two machines (150 kw. each); S. K. C. system, one switchboard wattmeter, poles and wires for construction of 3 miles of distribution lines, 100 5-amp. and 10-amp., 110-volt, 60-cycle, single-phase, two-wire meters. James E. Finn is superintendent of the municipal electric plant.

Hull, Que.

The Hull Electric Company have placed an order with the Ottawa Car Company for four, 43-foot semi-convertible single-end trailer car bodies.

The matter of extensions to the Hull Electric Railway's system from Hull to Gatineau Point is being discussed in the city council.

Hantsport, N.S.

Several propositions have been made to the town council for lighting the town by electricity. The matter will probably be put to a vote in the near future.

Humboldt, Sask.

A by-law was submitted to the electors on December 8. This was for defraying the cost of completion of the electric lighting plant and making extensions in the pole line.

Hamilton, Ont.

The contract has been awarded to the Canadian Westinghouse Company for electrical machinery and equipment to be installed in the Dundurn sub-station.

A by-law to authorize the expenditure of something over $1,000,000 for hydro-electric purposes is to be submitted in January.

Work has begun on the sub-station building on Dundurn street which is being built in connection with the municipal distributing system.

Lacombe, Alta.

We understand the town council will, in the near future, purchase a 100 kw. generator.

Lindsay, Ont.

The new street lighting equipment was placed in operation on December 1 along the main street of the town. The

system used is an iron standard carrying magnetite arc lamps. Wires are placed underground.

LePas, Man.

The wireless station at this point has been placed in commission and it is reported that messages can now be taken from points on the extreme east and west of the Dominion.

London, Ont.

The city has appointed the following commission to have charge of the electrification and operation of the London & Port Stanley Railway:—Hon. Adam Beck, Philip Pocock, Ald. Spittal, M. D. Faser, K.C., and the Mayor.

It has been finally decided to take a vote, at the January elections, on the operation of Sunday cars.

Medicine Hat, Alta.

On November 21 a by-law authorizing additional expenditures of $150,000 for power plant extensions and improvements was passed.

Montreal, Que.

Mr. C. Laurendeau, K.C., the chief attorney of the Montreal Council, has reported to the controllers that the Montreal Light, Heat and Power Company and the Public Service Corporation have the right to make use of the streets for their poles without the consent of the city. The companies were bound to give notice of what they were going to do, in order to give the city an opportunity to say where the poles were to be placed. The city may notify them that it believes it preferable that the wires be placed underground. If the companies refuse this request the city have the right to apply to the Public Utilities Commission to force the companies to put their wires in conduits; the decision rests with the Commission. The city are seeking power to amend the charter with regard to the erection of poles. The new clause will put all companies of public utilities on the same footing as regards their relations with municipal corporations, and make it obligatory on such companies to obtain the consent of municipal corporations before exercising any privileges in the streets. If a company and a municipal corporation do not agree on the conditions to be imposed, the matter is to be submitted to the Quebec Public Utilities Commission, which will decide between the parties.

Tenders are to be received by the Board of Commissioners up to December 18 for the installation of an electric clock system in the city hall annex.

The Bell Telephone Company will erect a new exchange on Ontario Street East, Montreal, at a cost of $215,000.

Under a Bill promoted by the village of St. Michel de Laval, near Montreal, the Quebec Legislature is asked to give authority to the municipality to enter into a contract for the construction and operation within its limits of an electric tramway service and to grant to any firm or corporation an exclusive franchise and exemption from municipal taxes for a period not exceeding fifty years. The Bill is strongly opposed.

Murray Bay, Que.

The Labrador El. & Pulp Company, Limited, of Murray Bay, expects to purchase within the next six months one 250 h.p. engine to operate an alternating-current generator for lighting the city; also within the next four months to purchase two transformers (10,000 kw.) and 50 cedar poles for repairing 20 miles of lines. J. O. Duguvay is manager.

Nelson, B.C.

The city's railway receipts are showing up considerably better than last year. For the first three weeks of November the average daily receipts were $39.64, as compared with $32.88 a year ago.

Orillia, Ont.

The Hydro-electric Power Commission of Ontario have been approached for a proposition to supply the town with power continuously from Big Chute. This would thus do away with the suggested installation of a new plant by the town of Orillia. Chief Engineer Gaby has been looking over the situation.

Princeton, B.C.

The Princeton Coal & Land Company have called for tenders for electrical equipment which, we understand, will cover the generation and distribution of a quantity of power for both motor and illumination work.

Port Arthur, Ont.

The Niles Car and Manufacturing Company of Cleveland are considering the establishment of a car factory at this point.

Picnic, Sask.

The Graham-Chatsworth Rural Telephone Company, Limited, have called for tenders for the construction of a telephone system at this point.

Rossland, B.C.

The council is looking into the matter of installing a new street lighting system.

Regina, Sask.

The operating returns of the municipal street railway system for the week ending September 29 were as follows:—Revenue, $4,263.55; passengers carried, 102,088; passengers, including transfers, 116,405.

The following rural telephone companies have been incorported in Saskatchewan:—Grand Bend Rural Telephone Company, Limited, Weyburn; Hillsdale Rural Telephone Company, Limited, Simpson; Tantallon Rural Telephone Company, Limited, Tantallon; Durham Rural Telephone Company, Limited, Wolseley.

The city of Regina has awarded a contract to Messrs. Willans & Robinson for a 3,000 kw. disc and drum turbine operating at 3,600 r.p.m., with steam at 180 lbs. pressure and 125 degrees super heat. The generator will be supplied by the Siemens Company of Canada and will be 3-phase, 60-cycle, 2200 volt. The turbine condenser will also be of the Willans & Robinson manufacture, of the Augmenter type, with an Edwards air-pump. The contract for the supply of a 25-ton hand operated travelling crane was awarded to the Whiting Foundry & Equipment Company. This equipment will be installed under the supervision of Mr. E. W. Bull, superintendent Light and Power Department of the city of Regina.

It is expected that the 1500 kw. turbo-generator unit will be installed in temporary housing and ready for operation by the new year. In a report recently issued it is stated that the output of the plant during the first ten months of 1913 amounted to 6,017,619 kw.h., an increase of about 90 per cent. over the amount produced a year ago.

A contract for the supply of a 3,000 kw. steam turbine with condenser has been awarded to Willans & Robinson. A 25-ton crane will be supplied by the Whiting Foundry & Equipment Company.

Saskatoon, Sask.

Ten street car conductors and one motor man were recently placed under arrest here for abstracting fares from boxes of the municipal railway system. The discovery was made by private detectives who first located one of the men

as the leader of a systematically organized enterprise. It is understood that this man has made an open confession involving the others arrested.

Two of the six street cars on order have arrived. These are of the double deck p. a. y. e. type, with a considerably larger capacity than the older cars.

For the first ten months of the year the total output of Saskatoon's power plant was 6,225,775 kw.h., as against 2,934,375 kw.h. for the corresponding period a year ago, or an increase of approximately 112 per cent. The highest peak load was 2,900 kw. A 3,000 kw. steam turbo-generator is at present being installed. During the month of October, just past, the commissioners report that 905,390 kw.h. were generated at a cost of $17,679, which works out to 1.95c per kw.h.

During the same ten months, 107 arc lamps have been erected bring the total number at the present time up to 270. The main streets are lighted by ornamental standards using tungstens.

For the first ten months the gross receipts from the street railway system have been $132,124, as against all charges of $144,520. At the present time 12 single truck cars operating with a seating capacity of 32 passengers each. Six new double truck cars are on order with a capacity of 44 each.

St. Thomas, Ont.

The city council is contemplating the installation of an ornamental cluster lighting system on the main streets.

St. Catharines, Ont.

The new electric line from St. Catharines to Niagara-on-the-Lake was opened for service on the first of December.

Shoal Lake, Man.

A by-law will be submitted on December 16 authorizing the issue of debentures to raise $15,000 for an electric light plant in Shoal Lake, Man., the debentures to run for 20 years and bear interest at 5 per cent. In our December 1 issue we stated in error that the date of this by-law was January 1.

Toronto, Ont.

The Wilton Avenue car line of the Toronto Railway Company has been placed in service.

The city solicitor has been instructed to look up all the franchises regarding underground railways in the city of Toronto with a view to having any cancelled which have not been lived up to.

Tilbury, Ont.

A by-law will be submitted on January 1 to raise money for the cost of installing a distribution system for electric light and power. The by-law will be for $10,000 which it is calculated with be sufficient to distribute 250 h.p.

Vancouver, B.C.

A local syndicate has made application to the city council for a franchise to operate motor buses on the streets and lanes of Vancouver. The application asks for a 20-year franchise, with exclusive rights, and in return agrees to charge the same fares as formerly given by the B. C. E. R. Company.

It is said that the railway department of the British Columbia government are conducting an investigation into the British Columbia Electric Railway Company's rates.

Watrous, Sask.

We are advised that the report that this town would submit a by-law authorizing the expenditure of $8,500 on an electric lighting plant was in error. There is no project to submit such a by-law.

Woodstock, N.B.

An application has been received from the Maine and New Brunswick Electric Company to erect poles and stretch wires in this town for the supply of light and power.

Wyoming, Ont.

An electric lighting system is contemplated in this town.

Welland, Ont.

The Electric Steel & Metals Company have commenced excavation work on the erection of their steel plant which will be built in part during the coming winter.

Weston, Ont.

It is expected that work on the re-distribution of the lights on Main Street will shortly be undertaken by the Weston Power & Light Commission.

Walkerville, Ont.

The ratepayers recently approved a by-law regarding the adoption of Niagara power to be supplied by the Hydro-electric Power Commission of Ontario.

Winnipeg, Man.

Tenders have been called by the Manitoba Government Telephone Commission for their supply of telephone instruments for the year 1914.

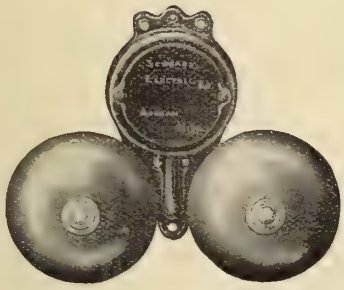
A contract has been awarded by the Board of Control to the Siemens Company of Canada for the supply of one 1500 kw. motor-generator set for the King Street sub-station.

LIGHTING SCHEDULE FOR DECEMBER, 1913.

Courtesy of the National Carbon Company, Cleveland.

Date.	Light.	Date.	Extinguish.	No. o Hours
Dec. 1	5 00	Dec. 2	6 20	13 20
2	5 00	3	6 20	13 20
3	5 00	4	6 20	13 20
5	10 40	6	6 30	7 50
6	11 40	7	6 30	6 50
8	0 40	8	6 30	5 50
9	1 40	9	6 30	4 50
10	2 50	10	6 30	3 40
11	3 50	11	6 30	2 40
12	No Light	12	No Light	
13	No Light	13	No Light	
14	No Light	14	No Light	
15	5 00	15	8 00	3 00
16	5 00	16	9 10	4 10
17	5 00	17	10 30	5 30
18	5 00	18	11 40	6 40
19	5 10	20	0 50	7 40
20	5 10	21	2 00	8 50
21	5 10	22	3 20	10 10
22	5 10	23	4 30	11 20
23	5 10	24	5 50	12 40
24	5 10	25	6 40	13 30
25	5 10	26	6 40	13 30
26	5 10	27	6 40	13 30
27	5 10	28	6 40	13 30
28	5 10	29	6 40	13 30
29	5 10	30	6 40	13 30
30	5 10	31	6 40	13 30
31	5 10	Jan. 1	6 40	13 30

Total Hours 249 40



We Have a Bell For Every Purpose

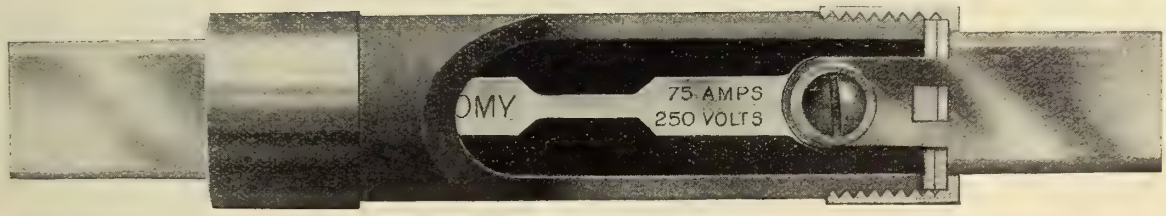
There can be only **one best** and that is the **Schwarze.** **No. 12 Common Magneto Extension** for telephone Service is illustrated herewith. The spools are large enough so that in no case is it necessary to use over No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and this wire **is all active.** Armature is under influence of coils its entire length. Poles arranged so that permanent magnet cannot be discharged, and will not weaken.

No. 13, same as No. 12, except larger and **very much louder,** and is for signalling purposes on high tension 60 cycle. Fully approved by Underwriters.

All weatherproof. · **Write for catalogue.** **All resistances.**

Schwarze Electric Co., Adrian, Michigan

Norton Telephone Co., Canadian Agents



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense** over 80 per cent by using

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.
Second, because it is the only renewable fuse that is uniformly rated.
Third, because it is the only design so far produced that provides the desired electrical characteristics.
Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.
Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.
Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

Economy Fuse & Mfg. Co. of Canada, Limited

Herald Building, Montreal

ECONOMY Renewable Fuses are sanctioned by the Canadian Fire Underwriters' Association.



Type "E" or Blade -600 A. 250 or 600 V

Refillable Fuses for Electric Lights and Circuits are being adopted by all large users of Fuses.

IN TYPE "E" FUSES, the fusible element is made in the form of a strip, with capacities stamped thereon. It will carry 10% overload indefinitely, and guaranteed to blow at 25% overload or less, which meets the most exact requirements.

CATALOGUES and SAMPLES for the asking

Sole Manufacturers

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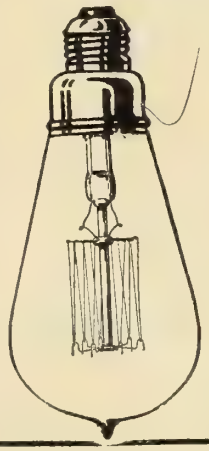
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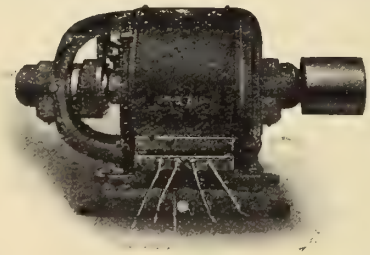
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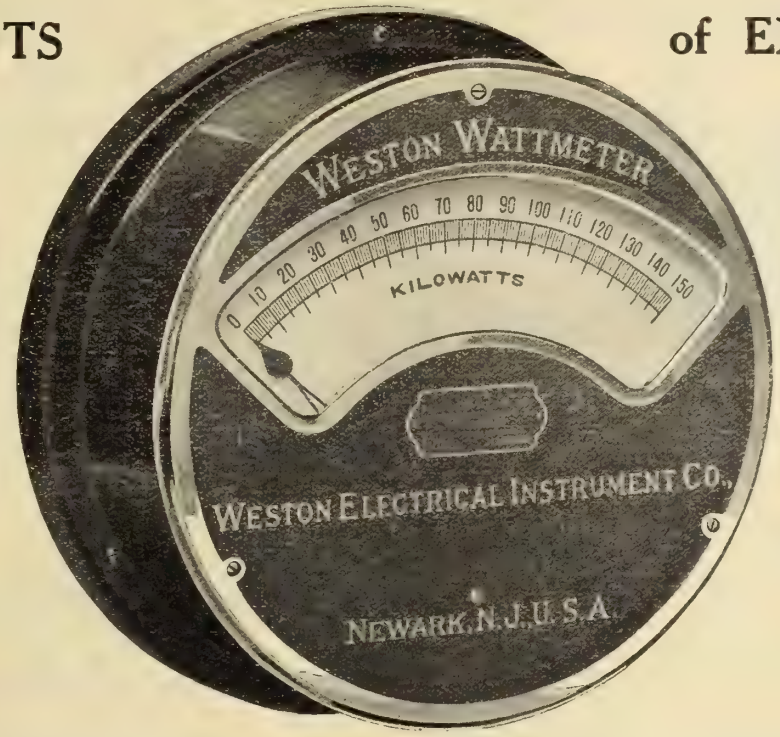
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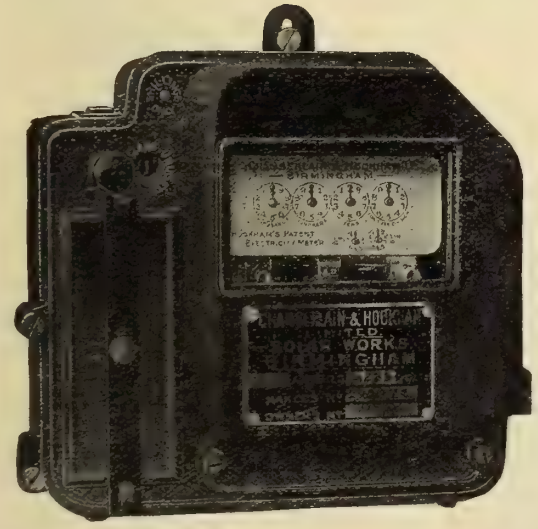
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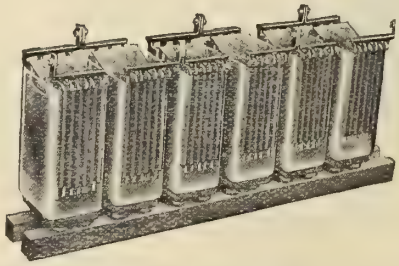
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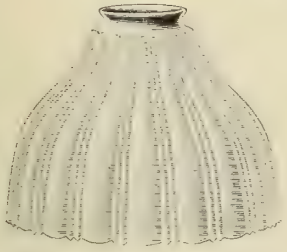
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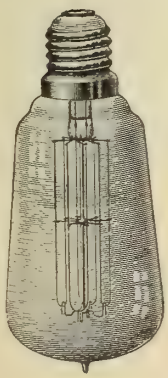
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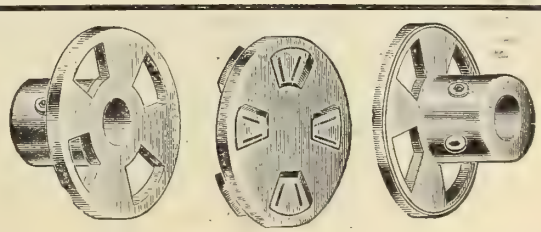
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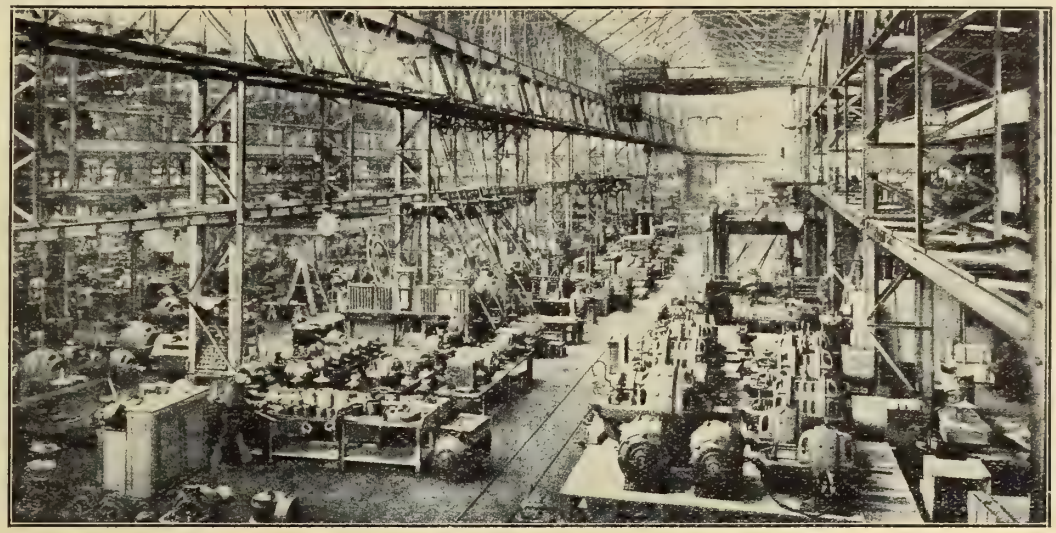
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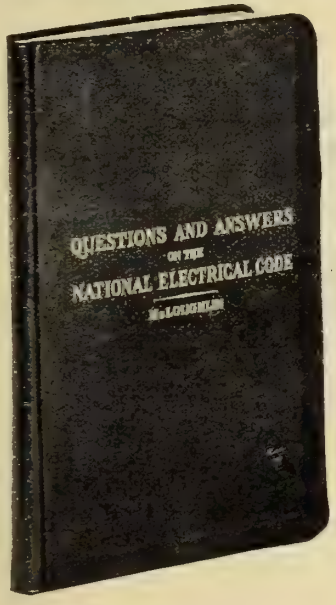


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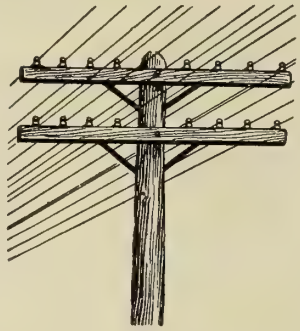
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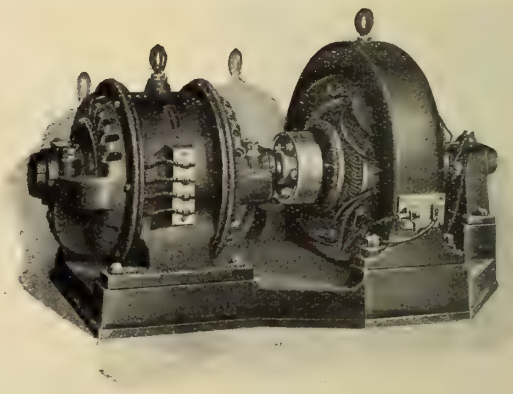
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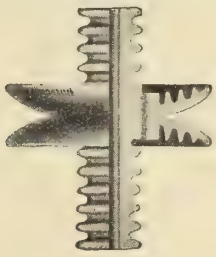
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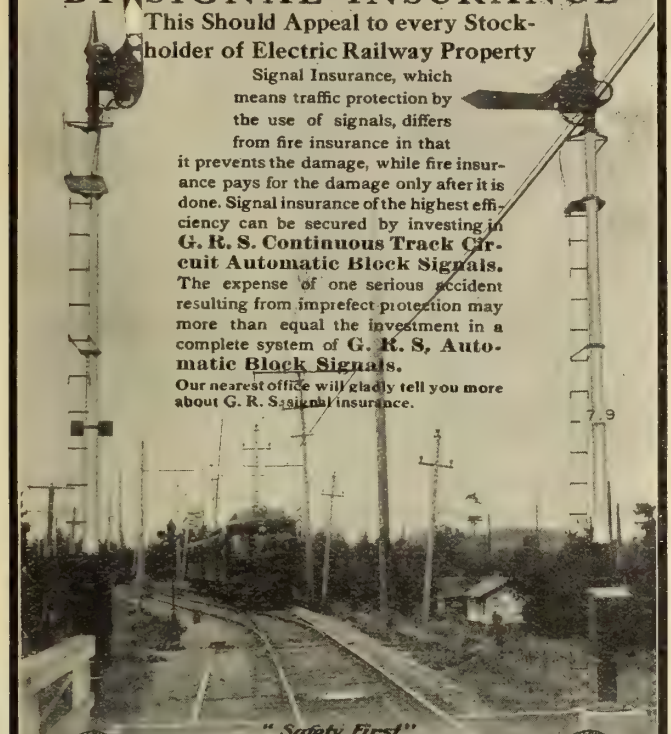
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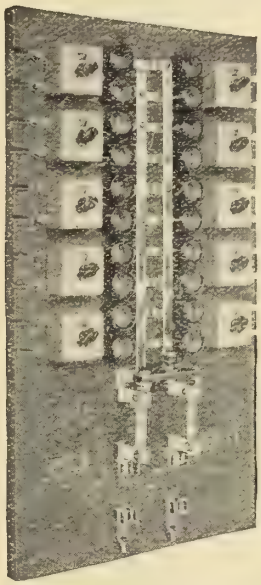
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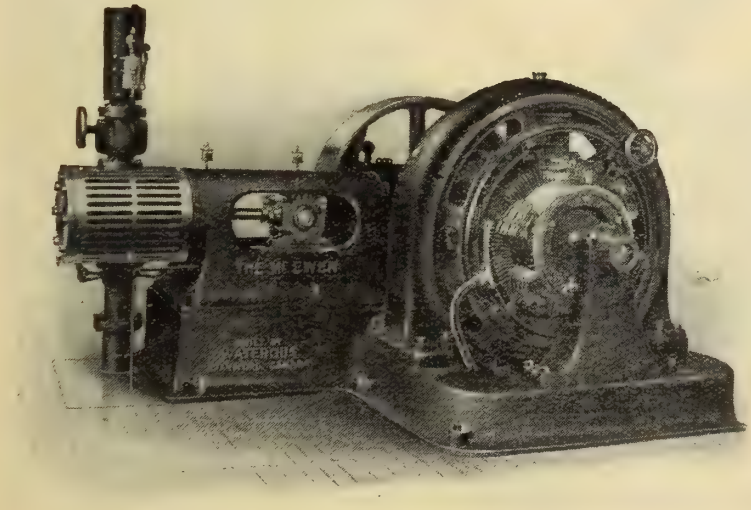
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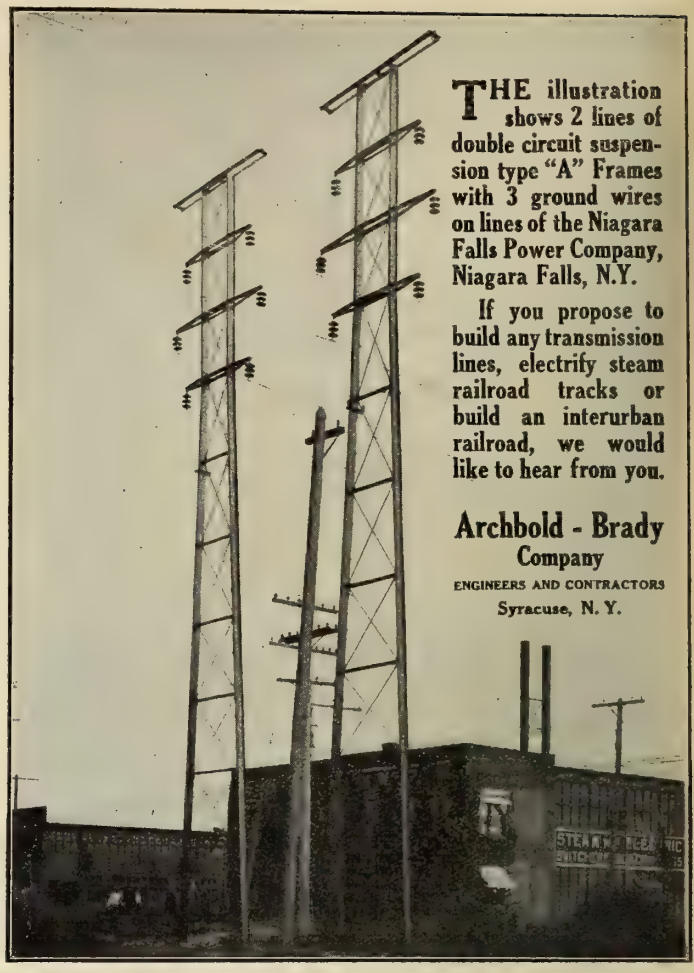
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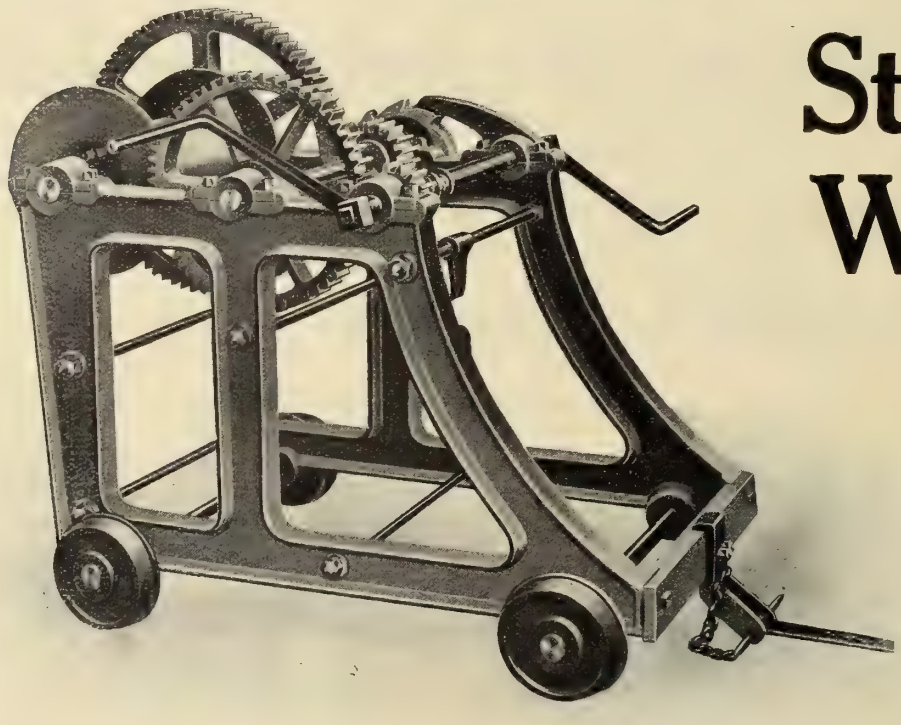
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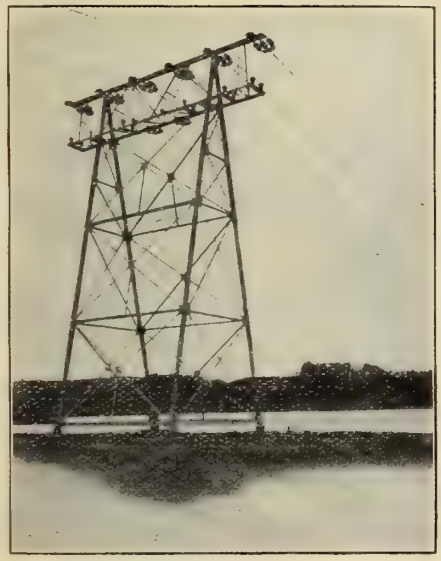
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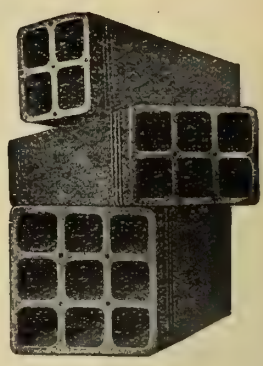


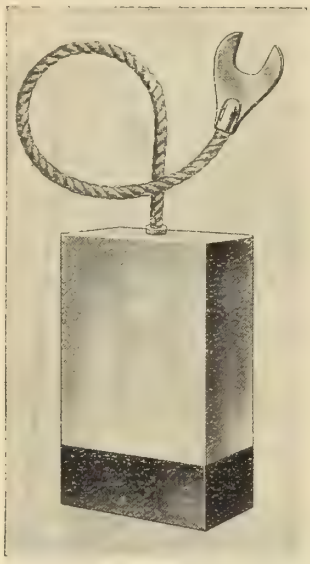
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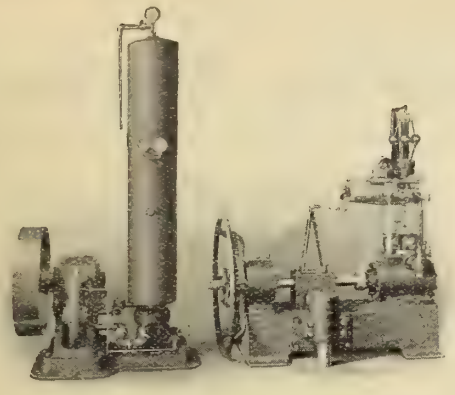
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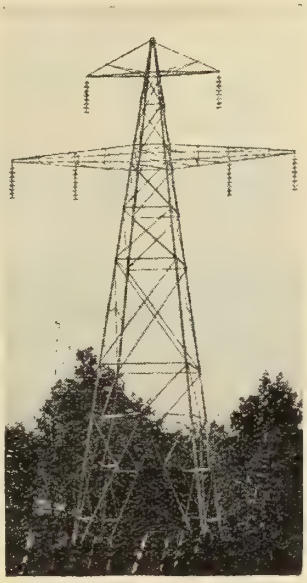
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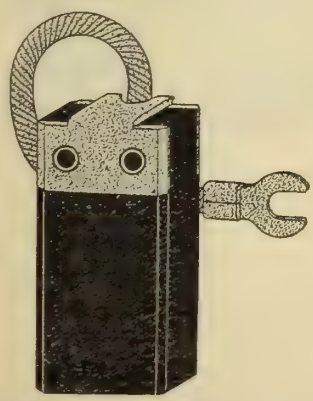
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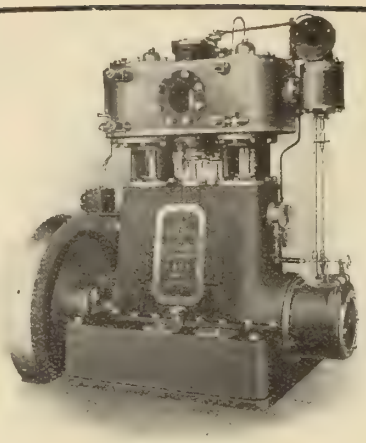
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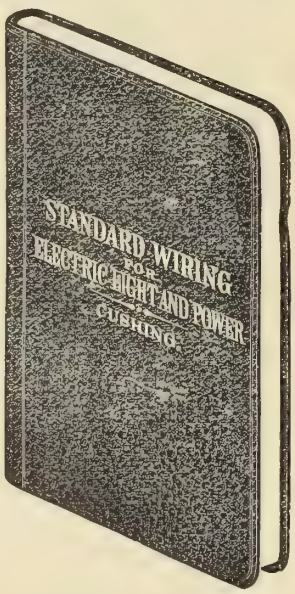
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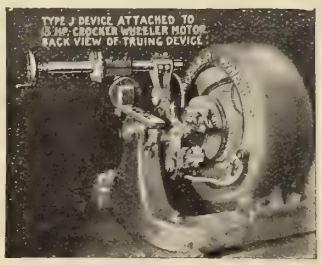
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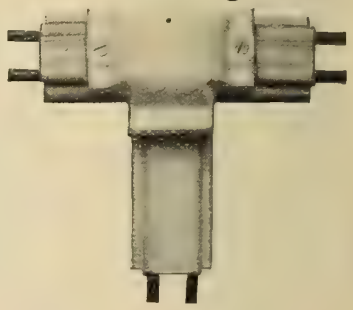


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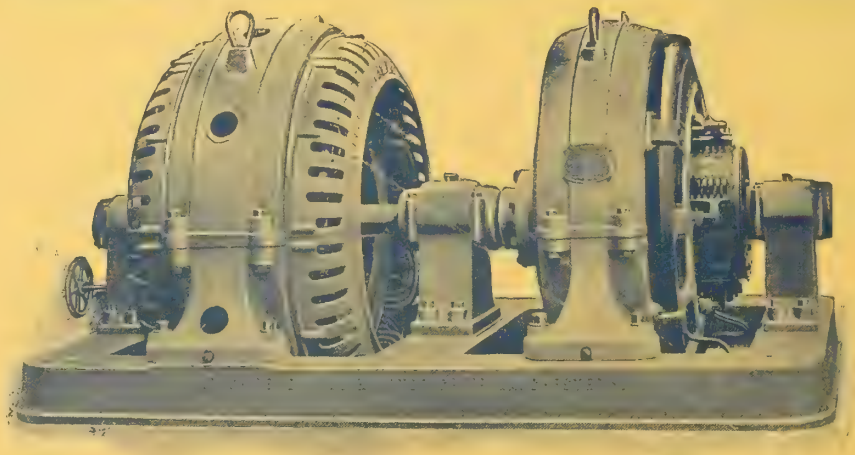
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